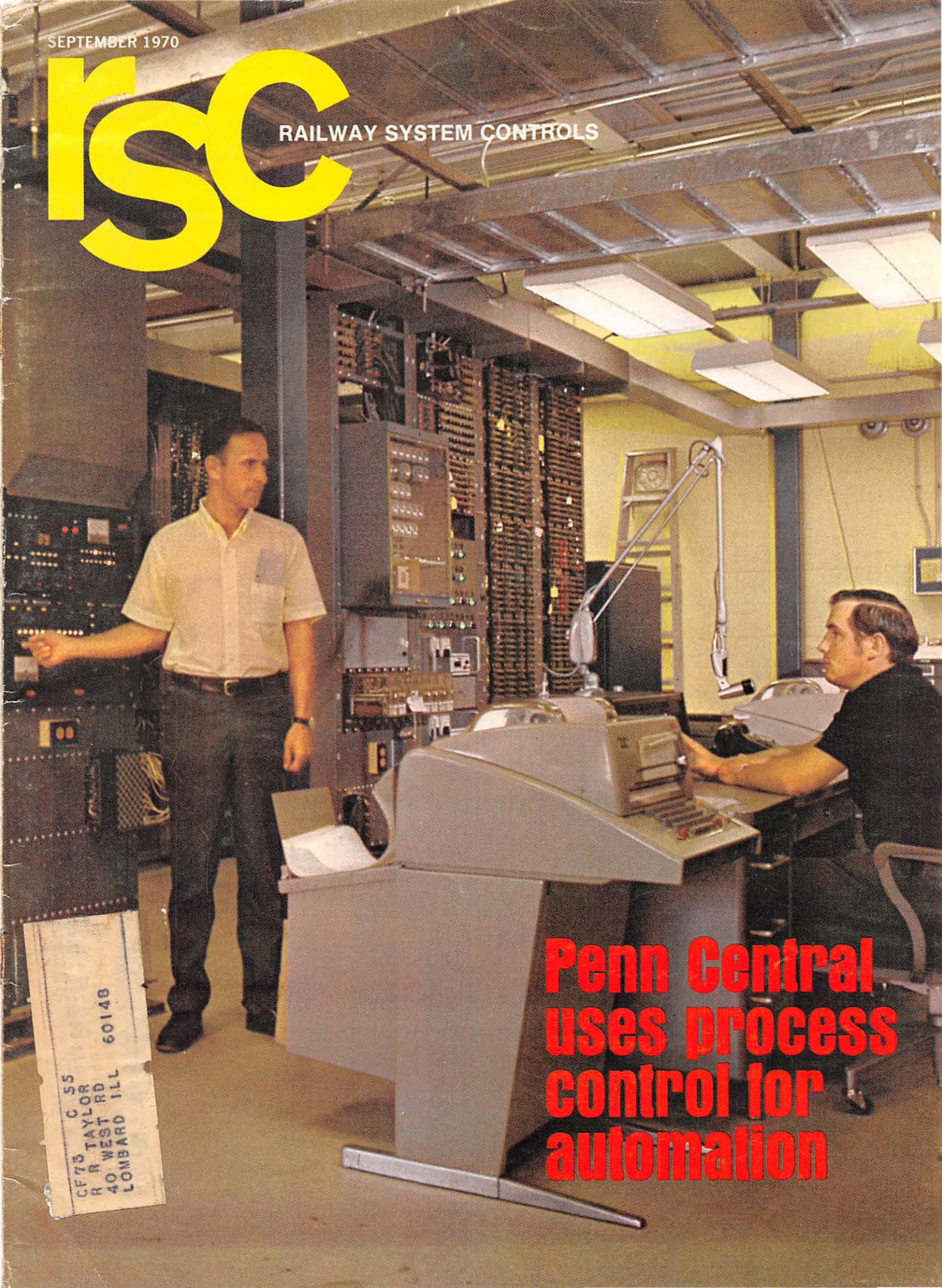
SEPTEMBER 1970

rsc

RAILWAY SYSTEM CONTROLS



Penn Central uses process control for automation

CF73 C 55
A R TAYLOR
40 WEST RD
LOMBARD ILL 60148

THREE REASONS

to visit BOOTHS 120-121

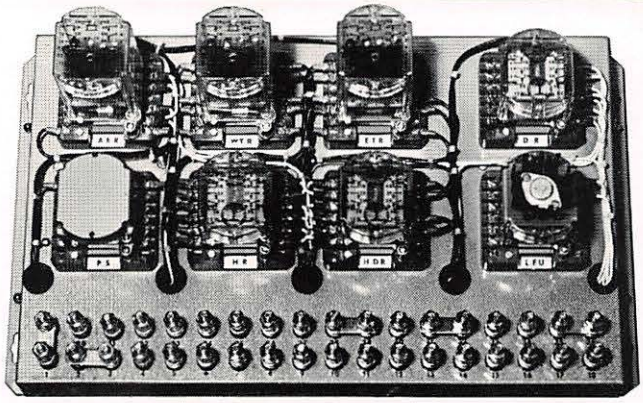
AT THE **AAR** ANNUAL MEETING

Communication and Signal Section
in San Francisco Sept. 15-16-17, 1970

1

RACO® UNILENS®

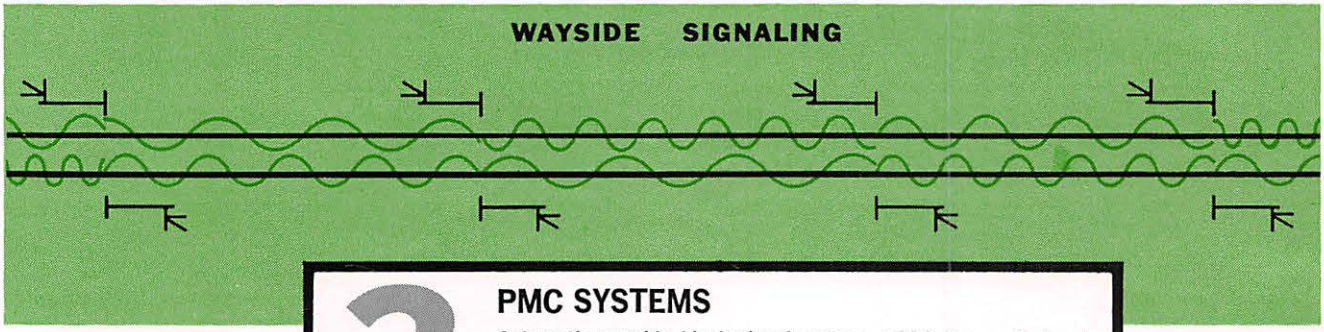
The unique single lens colorlight wayside signal that provides up to four color indications at less initial cost, at less installation cost, and at less maintenance expense as there is no mechanism. It is available in aluminum for mast (top, front, or side), bridge, and bracket mountings, as well as for dwarf signal, and (shown now for the first time) rapid transit signaling.



2

RACO® ABS SIGNAL PACKAGE

Another new approach to reduce equipment and space requirements. Retains conventional wayside signal control circuitry using RACO® proven MR-10 relays and LFU-12 flasher.



3

PMC SYSTEMS

Automatic wayside block signal systems which transmit signal controls thru the rails (eliminates line wire, and insulated joints with exceptions) using audio frequency carriers. The systems are compatible with AC or DC electrical propulsion currents, DC coded track, AC signal circuits, and coded cab signals.

RPI RAILWAY PROGRESS INSTITUTE

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Railroad Accessories Corporation

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Circle 12 on reader service card

no costly site selection with a Cable Communication System installed along your right of way

The very fact that you have a right of way established eliminates searching for specialized antenna sites where land availability requires a high premium.

Cable Communication Systems, either buried or aerial, run right along your right of way and are not subject to interference caused by severe weather conditions.

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Seven basic systems provide 48, 120, 132, 300, 360, 1260 or 2700 channels. And only a Cable Communication System allows access to the base band, at any point along the line, through the use of line extraction units — with no local power or expensive equipment required.

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If you have the right of way, we have the right communication system to go along with it backed by 25 years research and operation experience. For complete information write for the CCS brochure. Or call (212) 757-9130 ext. 37.

CABLE COMMUNICATION SYSTEMS, INC.
50 Rockefeller Plaza, N. Y., N. Y. 10020

Gentlemen:

I would like to learn more about Cable Communication Systems for my right of way. Please send me your latest CCS brochure. ☐

My most urgent communications problem is (describe).

_____

Name _____

Company _____

Street _____

City _____ State _____ Zip _____

CABLE COMMUNICATION SYSTEMS, INC., 50 Rockefeller Plaza, New York, N.Y. 10020

Cable Communication Systems, Inc. is owned by CIT-Compagnie Industrielle des Télécommunications, a subsidiary of CGE-Compagnie Générale d'Eléctricité.

Circle 15 on reader service card

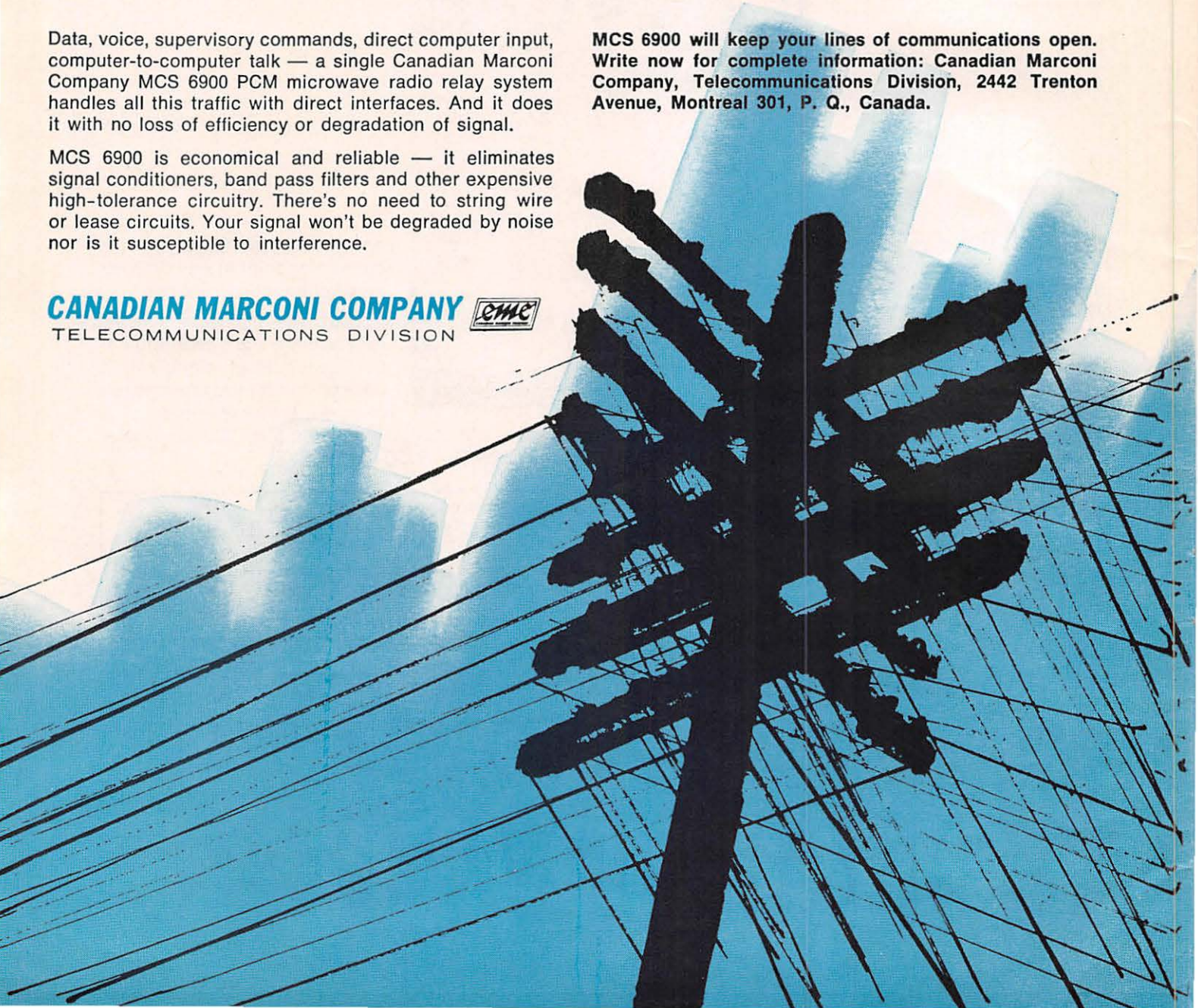
Before your lines of communication break down ... use PCM-ON-RADIO to transmit data *and* voice messages

Data, voice, supervisory commands, direct computer input, computer-to-computer talk — a single Canadian Marconi Company MCS 6900 PCM microwave radio relay system handles all this traffic with direct interfaces. And it does it with no loss of efficiency or degradation of signal.

MCS 6900 is economical and reliable — it eliminates signal conditioners, band pass filters and other expensive high-tolerance circuitry. There's no need to string wire or lease circuits. Your signal won't be degraded by noise nor is it susceptible to interference.

MCS 6900 will keep your lines of communications open. Write now for complete information: Canadian Marconi Company, Telecommunications Division, 2442 Trenton Avenue, Montreal 301, P. Q., Canada.

CANADIAN MARCONI COMPANY CMC
TELECOMMUNICATIONS DIVISION



SEPTEMBER 1970 VOL. 1 NO. 6

RSC RAILWAY SYSTEM CONTROLS

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Designs and Manufactures these Cables Specifically for Railroad Applications

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The quality and reliability of RR SC 108 has been proved during ten years service to major eastern carriers.

Provides these advantages over other types of jacketing and insulation:

- Low density, high molecular weight polyethylene
- Lighter weight . . . smaller diameter
- Greater dielectric strength . . . for years longer
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RR 885 P Paired Aerial
RR 885 P 5 & 10 CU Paired Buried
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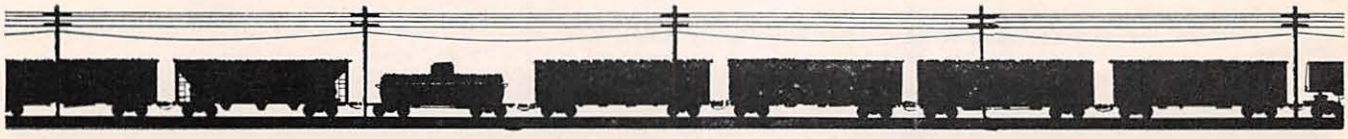
Since the introduction of plastic insulated communication cable, more than 100,000 miles of Ansonia cables have provided exceptional reliability at installations throughout the U.S.

This performance record has been achieved because Ansonia:

- Manufactures only cable
- Offers experienced engineering design



onia

- Custom designs cable as needed
- Uses the most modern manufacturing equipment and methods
- Normally exceeds specifications
- Provides technical assistance and back-up service

Specially Designed Railroad Cables

Custom design and construction of special cables has always been an important part of Ansonia's operation.

Working independently, or in cooperation with customers' engineers, our engineering department has been involved in a broad range of innovative developments. Included are unusual combinations of jacketing and shielding to meet a broad range of special conditions.

These conditions are represented by special purpose cables such as Hot Box Detector Cable, Shielded Communication Cable, Static Line Wire, Snow Removal Cable and many others.

No matter what your cable problem, our design engineers will be glad to help you solve it. In fact, this is just one part of our determination to be a prime source of cable for Railroads.

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Beyond engineering design and construction, Ansonia provides these important extras:

- Rigid Quality Control standards
- Finest materials & workmanship
- Highest degree of reliability
- Dependable delivery schedules
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- Agents experienced in your industry

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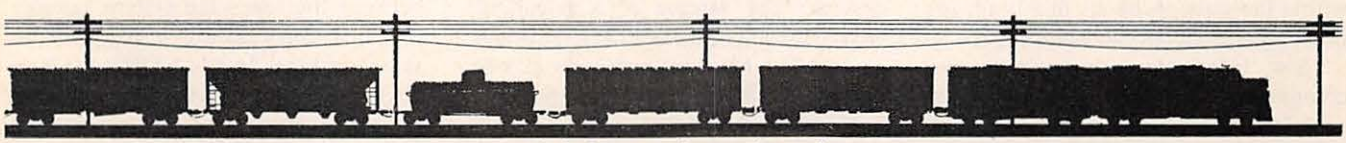
- B.W. Parsons Company
  818 Pioneer Building
  St. Paul, Minnesota 55101
  612-227-6511
- Western-Cullen Division
  Federal Sign & Signal Corp.
  2700 W. 36th Place
  Chicago, Illinois 60632
  312-254-9600

Ansonia

The Ansonia Wire & Cable Co
Ashton, Rhode Island 02864
Telephone 401-724-6400



Circle 17 on reader service card

A simplified look at how T-carrier works and what it does for railroad communications

HOW IT WORKS

STROMBERG-CARLSON T-Carrier System employs pulse code modulated (PCM) carrier techniques to carry 24 high-quality voice channels over two telephone cable pairs.

Pulse code modulation means, in the simplest terms, giving a series of pulses the job of carrying the description of a minute portion or sample of a telephone signal from one point to another. Then, by sending descriptions of enough portions or samples of the signal, the signal can be reproduced at the distant end. A carrier system using pulse code modulation converts these telephone signals into series of pulses for transmission over wire, then reconstructs the signals at the distant end to provide a more efficient communications channel. How this is done is quite easy to understand and is well within the state-of-the-art in this age of microsecond electronic operations.

First, information theory tells the communications engineer how many samples of a signal must be described to the receiving carrier terminal by the transmitting terminal in order for the signal to be reproduced faithfully. In telephone conversations, if we take a sample each 125 millionths of a second, we get a faithful reproduction. So each 125 microseconds the sending terminal measures the size, or amplitude, of the signal at that instant. This amplitude measurement is the description of the sample of the signal.

The second step in the operation of a pulse code modulation carrier system involves a fact that may seem impossible, but it is proven by performance to be true. This fact is that one of 127 amplitude descriptions will adequately describe any sample of a telephone signal. If each of these 127 descriptions could then be transmitted from one carrier terminal to another, any signal could be reproduced at the distant end.

To get these 127 amplitude descriptions into a form which can be transmitted, a code has been devised which provides us with 127 identifiable series of pulses something like those created by operation of an ordinary telephone dial.

So, the sending terminal assigns one of the 127 codes of pulses which best describes the portion or sample of the signal obtained in the first phase of operation.

The next step in PCM carrier operation is the conversion of the assigned code from direct-current pulses to a more convenient and efficient alternating-current signal to carry it over regular telephone facilities. This step is only incidental to the pulse code modulation method, because in the next step, at the receiving terminal, the alternating-current signal is simply converted back to direct-current series of pulses which describes the sample of signal originally taken.

The last step, then, is the recognition by the receiving terminal of the code assigned to the sample of the signal and the emission of its identical twin, which it obtains from its vocabulary of 127 signals. The signal is thus electrically reproduced and ready for an acoustical device such as a telephone receiver.

But, of course, not enough would be gained if only one conversation were sampled for transmission in this manner. In the first phase of operation, we are told that a conversation must be sampled every 125 microseconds—so between the times the system samples this first conversation it has time to sample others. In the STROMBERG-CARLSON T system, it has time to sample 23 other conversations and send

the information on. Since the terminals are locked in synchronism, the channels are always kept in their proper order.

BENEFITS OF PCM CARRIER

There are several 24-channel cable carrier systems using **F**requency **D**ivision **M**odulation. What does PCM offer over FDM?

Protection of Signal from Noise and Distortion

Noise and distortion have greatly reduced effect on PCM. Since these disturbances can enter the FDM system along the line, they are amplified at repeaters and result in some form of disturbance in the user's ear. In PCM, it's simple: once the sound portion is coded, only rare disturbances can upset this coding. The PCM codes will, therefore, go through unaltered and be reproduced. The principal sources of signal distortion in FDM systems are the repeaters along the line, particularly during heavy traffic. In PCM, only the pulse is being repeated; there is nothing to distort.

Highest Immunity to Crosstalk Brings Higher Percentage of Cable Fill

Limitations on cable fill are a product of crosstalk. The crosstalk problem, which is common to FDM systems, is reduced by PCM techniques. PCM recognizes only signals above a certain strength. Repeating and decoding are done before pulses fall below the recognition level. Crosstalk is simply blocked out. The result is more efficient utilization of pairs in each cable.

Unmatched Data Transmission

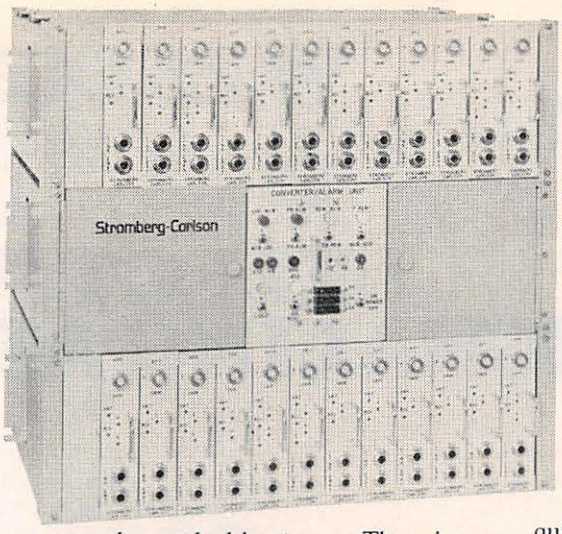
All 24 channels can be fully loaded with data in both directions without sacrificing quality. In a system with 23 channels loaded with data, the 24th channel can carry voice with no degradation of quality.

BENEFITS OF STROMBERG-CARLSON DESIGN TO RAILROAD COMMUNICATIONS

The STROMBERG-CARLSON T design uses the very latest proven electrical and mechanical design techniques and gives the user these advantages:

Built-in Troubleshooter

Our system automatically monitors for the spurious signals. Determination of whether the trouble is in the incoming or outgoing line signal is immediate. Since there is no need for special test equipment to make this determination, there is no interruption of service. When a problem occurs, a spare span



can be patched in at once. There is no question about its being operational, since our detection system monitors this circuit. Automatic error detection which provides this very valuable feature is standard in the STROMBERG-CARLSON T-1 system.

Rapid Expansion without Service Interruption

Terminals need not be fully equipped with channel units. Plug-in channel units can be added, removed, or changed at any time without interrupting service on other channels. Each repeater case holds up to 24 two-way repeaters (for 576 two-way channels). Adding repeaters is simple, quick, and inexpensive.

Repeater Interrogated from Central Office

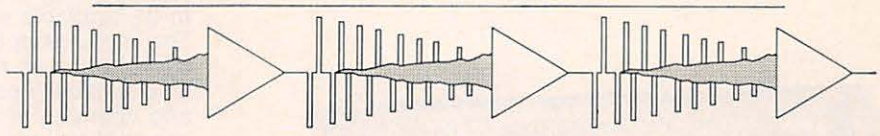
Repeaters for the system are powered over the physical. The operating condition of the repeaters can be verified from either terminal by built-in interrogation equipment.

Saves Expensive Floor Space

Each basic 24-channel terminal requires only 15¾ inches of vertical space on a standard 19-inch equipment rack. Eight complete terminals (192 channels) can be mounted on one standard 11′6″ rack; six terminals mount on a 9′ rack.

Lower Installation Cost

Each basic 24-channel terminal assembly is completely wired and tested before it is shipped. Only an external drop, power, and line connections are required.



Symbol represents voice signals with noise and crosstalk as rough overlay.

The symbol represents voice signals being transmitted on Stromberg-Carlson T-1 Carrier as a bipolar, binary train of pulses, with noise and crosstalk as a rough edge overlay. The pulses are attenuated as they travel the cable pair to the first repeater while noise and crosstalk are increasing. The repeater recognizes and regenerates the pulses, virtually eliminating noise and crosstalk, and the process is repeated.

TRANSMISSION PRODUCTS FOR OPEN-WIRE USE

S-C 761 Party Line Carrier: a transistorized medium-haul three- or four-channel system that can reduce load on message circuits by as much as 75%. The system upgrades way stations operating with 35-40 parties per line to only 10 or fewer parties per line. For additional efficiency and economy, the 761 is convertible to our 765 Trunk Carrier System.

S-C 661 Party Line Carrier: a 12-channel stackable double-sideband system that provides one to 12 full-duplex voice channels on a single VF telephone circuit. Each channel can serve up to 10 parties, with selective ringing of each. Choice of plug-in cards provides bridged, divided, or superimposed ringing.

For complete information on any of these communication systems, call Jim Codd at (716) 482-2200. Or write Railroad Division, Stromberg-Carlson, 100 Carlson Road, Rochester, N. Y. 14603.

Stromberg-Carlson

A Subsidiary of General Dynamics

Circle 18 on reader service card

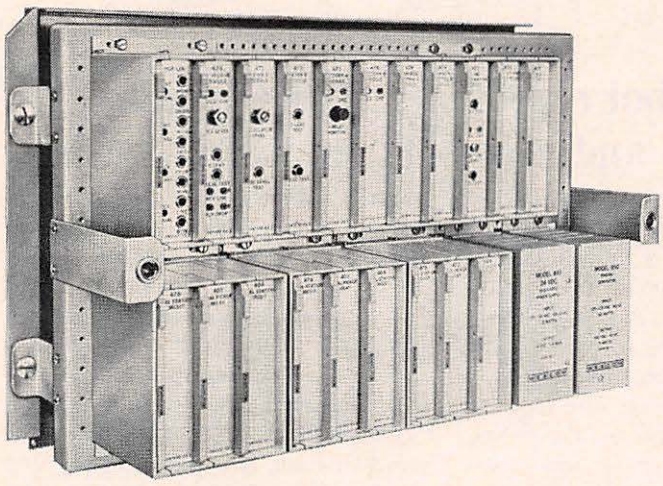
WESCOM Type 47 SSIA SELECTIVE SIGNALING ASSEMBLY

Compact, easy to install, compatible plus off-the-shelf delivery are the impressive advantages of Wescom's selective signaling assembly.

Until now, there was only one manufacturer of SSIA selective signaling equipment, and because of the many demands for this type service plus extensive installation and testing time, many service dates were missed: Those days are over . . . Now there's WESCOM!

The Wescom Type 47 SSIA Selective Assembly is a complete, four-wire, private line communication system. All equipment, including signaling, terminating, station circuits, and power is provided in a standard apparatus case, factory wired, tested, ready for installation.

Frequency-shift, inband-tone signaling and decoder logic provide individual two-digit dial selection of up to 81 available station, group, or broadcast codes. The modular construction of the Type 47 Assembly allows degrees of flexibility, expansion, and maintainability previously unattainable. Rearrangements and changes of the basic package can be accomplished by simply adding or removing plug-in modules and making simple changes in the wire-wrap connections at the rear of the assembly.



Visit our Wescom display at the Railway Signal & Communications Suppliers Show Hilton Booth #208

Some Features...

- Prepackaged modular assembly greatly reduces installation and maintenance time.
- Manual and/or automatic privacy with intrusion and/or override can be optionally provided.
- Dial-on conference capability allows any number of off-premise stations or up to 20 on-premise station groups to be successfully dialed into a conference call without degradation of transmission quality.
- Test jacks and variable controls allow rapid alignment and testing.
- Adjustable receive-level provides attenuation or amplification (−20 to +2 dB).
- Adjustable oscillator level permits use with nonstandard facility levels such as in special FAA and COAM applications.
- Special assemblies providing, for example, relay-rack mounting and special options such as CO or PBX access, are available upon request.

There's a lot more to say about our Type 47 Selective Signaling Assembly, but we would rather have our sales engineer tell you. Give him a call today or write for our Type 47 brochure.

WESCOM

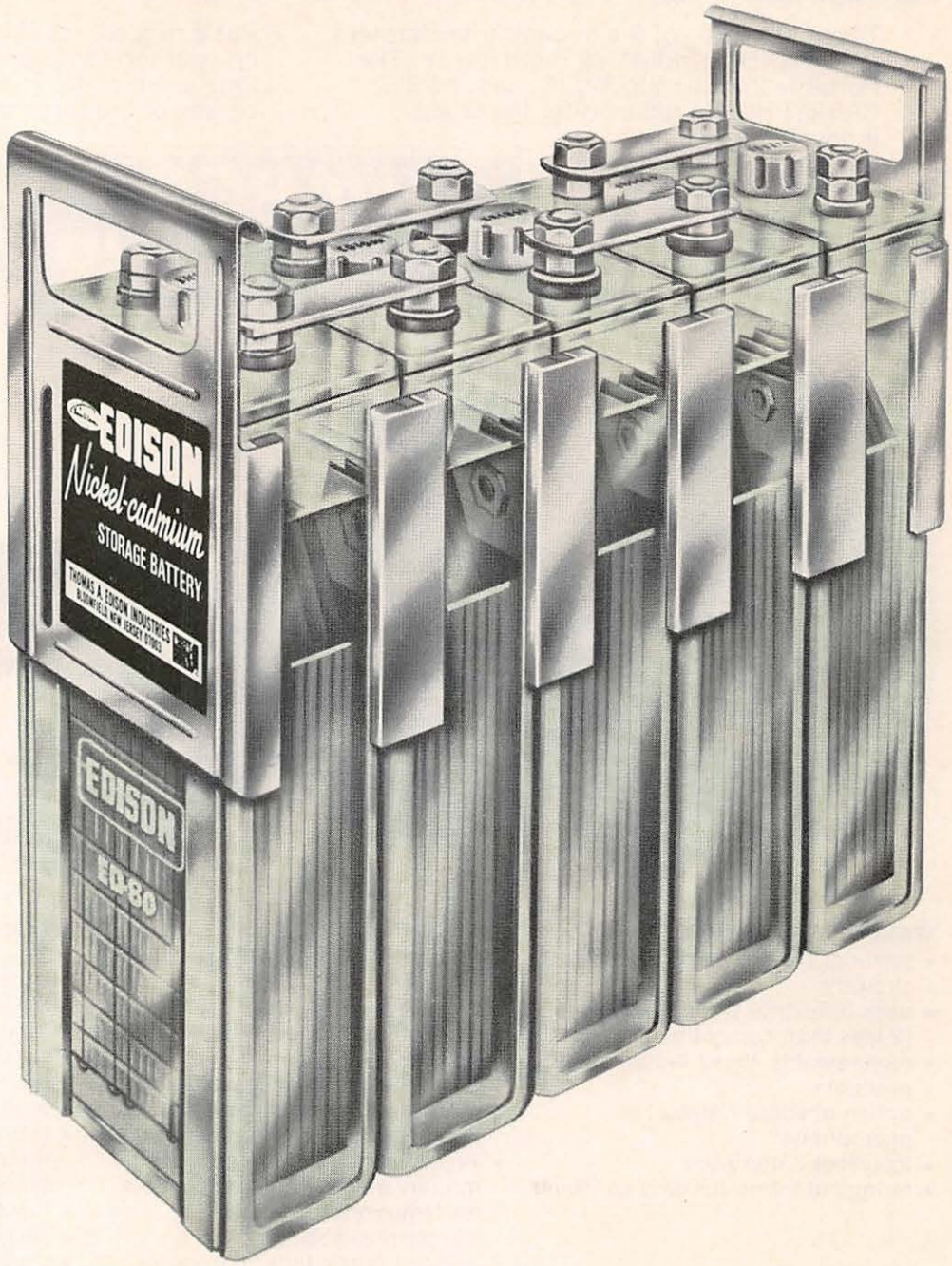
P.O. Box 458
Downers Grove, Illinois 60515
(312) 971-2010 • TWX 910-695-4735

In Canada: Wescom Canada, Ltd.
87 Brydon Dr., Rexdale, Toronto
(416) 742-0236 • TWX 610-492-4367

Circle 19 on reader service card

For Signaling and Communications applications you can choose from any of several makes of storage batteries on the market.

It's good to know that so many railroads now prefer and specify **EDISON** for these important services.



Manufactured entirely in the U.S.A. by one of the oldest names in the business —

THOMAS A. EDISON INDUSTRIES
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McGRAW EDISON

Circle 20 on reader service card

tune in this great new radio show for the 70's

These are three of the superstar performers in the WABCO industrial radio lineup. The Portable 2.2, the 3R/3V/3D, and the 5W CARRYPHONE® radios offer the latest innovations in radio design. Modular plug-ins, solid state operation, interchangeability, easy serviceability, lightweight, rugged construction, and prices competitive or lower than comparable radios.

WABCO ON THE AIR

Put a rugged, reliable WABCO radio to work on your job for improved communications and long service life. For complete information on any of the three radios shown below or a free demonstration, contact your WABCO Sales Representative. Or write Westinghouse Air Brake Company, Signal & Communications Division, Pittsburgh, Pennsylvania 15218.

WABCO 5W CARRYPHONE®
- modular plug-in battery pack circuitry
- uses industrial D-Cell batteries (2 less than competitive models)
- rechargeable Nicad battery pack available
- option of either handset or microphone
- foolproof battery box
- swing out frame for easy servicing

WABCO Portable 2.2
- weighs 30 ounces, displaces 47½ cu. in.
- 14 plug-in modules
- compatible with all VHF-FM systems
- complete line of accessories
- most power per ounce of any hand-held portable on the market
- rugged construction—exceeds military environment tests specs for temperature, humidity, vibration and shock
- average repair time: 8 minutes
- priced $75 to $100 lower than competitive models

WABCO 3R/3V/3D
- 3R—locomotives, cabooses and base stations
- 3V—vehicle trunk mount
- 3D—vehicle dash mount
- smallest 35 watt radio on the market
- plug-in modules
- transmitter and receiver interchangeable with all WABCO models
- low standby drain
- accessories for any system
- proven reliability and performance in railroad market for 1½ years
- quiet line (tone squelch)

WABCO

An American-Standard Company

See our WABCO radios in booth 100-101 at the AAR-C&S Section in the San Francisco Hilton Sept. 15-17

Circle 22 on reader service card

NIFE ON THE ILLINOIS CENTRAL

NIFE nickel cadmium battery reliability now serves the Illinois Central.

For automatic highway crossing protection, classification yard control, track circuits, automatic block signals.

And when Illinois Central recently relocated five control machines to Chicago Headquarters for improved central dispatching, NIFE batteries were specified for this severe around-the-clock service.

NIFE's full line of RP and RS railway signaling batteries includes sizes to 407 ampere-hour capacities in plastic containers, and even larger in steel. For railroad applications requiring high-discharge currents, such as for car retarders and stationary engine cranking, NIFE cell types HIP/HI and MDP/MD are available in a variety of ampere-hour capacities.

NIFE also manufactures solid-state battery chargers and battery/charger consoles for special applications.

Ask for your copy of NIFE's railway-battery catalog.

NIFE 32-volt RP-168 CTC battery installed at ICRR Headquarters.

NIFE®

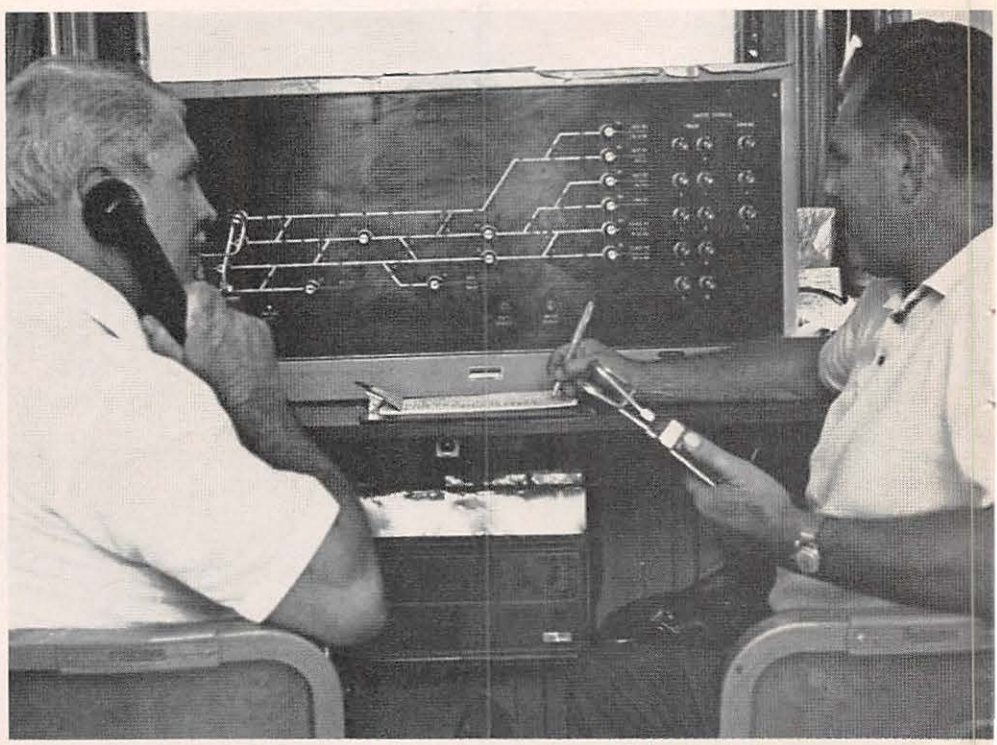
NIFE Incorporated
Copiague, Long Island, New York 11726
Telephone: 516-691-3240
Marketed in Canada as **JUNGNER** batteries by Cipel & LeCarbone, Ltd.

HUMP CONDUCTOR compares switch list with cars being classified. He has direct input to yard computer.

Penn Central automates Buckeye

Penn Central's Columbus, Ohio terminal improvement can be summed up in two words: "Buckeye yard." The immediate gain for customers is that cars now average only 25 hours (arrival to departure) in Buckeye yard, whereas before the new yard was in operation, cars might spend 4-5 days in the Columbus terminal area.

Opened for service Dec. 15, 1969, the new $26 million Buckeye yard is a 40-classification track automated retarder yard on the western edge of the city between PC mainlines that go to Chicago, Toledo, and Indianapolis and St. Louis. Columbus is a midwestern terminal for PC. From here mainlines radiate north and east to Detroit, Cleveland, Buffalo and Selkirk (gateway yard for New England and New York). Eastward from Columbus, the PC mainline runs to Pittsburgh and Philadelphia. Southward a freight line runs to the West Virgina coal fields and Charleston. Westward from Columbus, PC lines run to Logansport, Ind., Chicago, Indianapolis and St. Louis, and southwest to Cincinnati.



PULL-BACK CONDUCTORS radio their engines, and control lead switches.

MANAGEMENT INFORMATION

Penn Central has modernized a key midwest terminal by installing a new automatic classification yard using process control computers. Known as Buckeye yard, this Columbus, Ohio facility is currently classifying 2500-3000 cars daily. The new yard, constructed on the west side of the city, provides improved control of traffic through the terminal area. Work formerly handled at eight yards is now centralized at Buckeye. Four of these yards will be available for urban redevelopment.

Immediate benefits to shippers, from the yard which opened Dec. 15, 1969, is a considerable reduction in time cars spend in Columbus terminal. What formerly took 4-5 days to handle cars through Columbus now takes about 25 hours. Buckeye yard is also blocking cars for the St. Louis gateway connections to MP and StLSW, and to SOU at Cincinnati for Atlanta, Ga. and Chattanooga, Tenn.

class yard

To reduce congestion in the Columbus area, New York Central—prior to merger with the Pennsylvania—had considered constructing a new retarder yard. Following merger, however, the idea of improved terminal operation was reviewed. Because the existing eight yards were too small and most were in urban areas, the decision was made to construct an entirely new classification yard.

The site chosen, on the western edge of the city, enabled PC to have an entirely new facility that would take care of present traffic needs, and yet would have room for expansion to meet future requirements. The present 40-track, 4-group classification yard holds 2,060 cars. Track capacity ranges from 42 to 61 cars. There is room for two more groups for tracks 1-10 and 51-60.

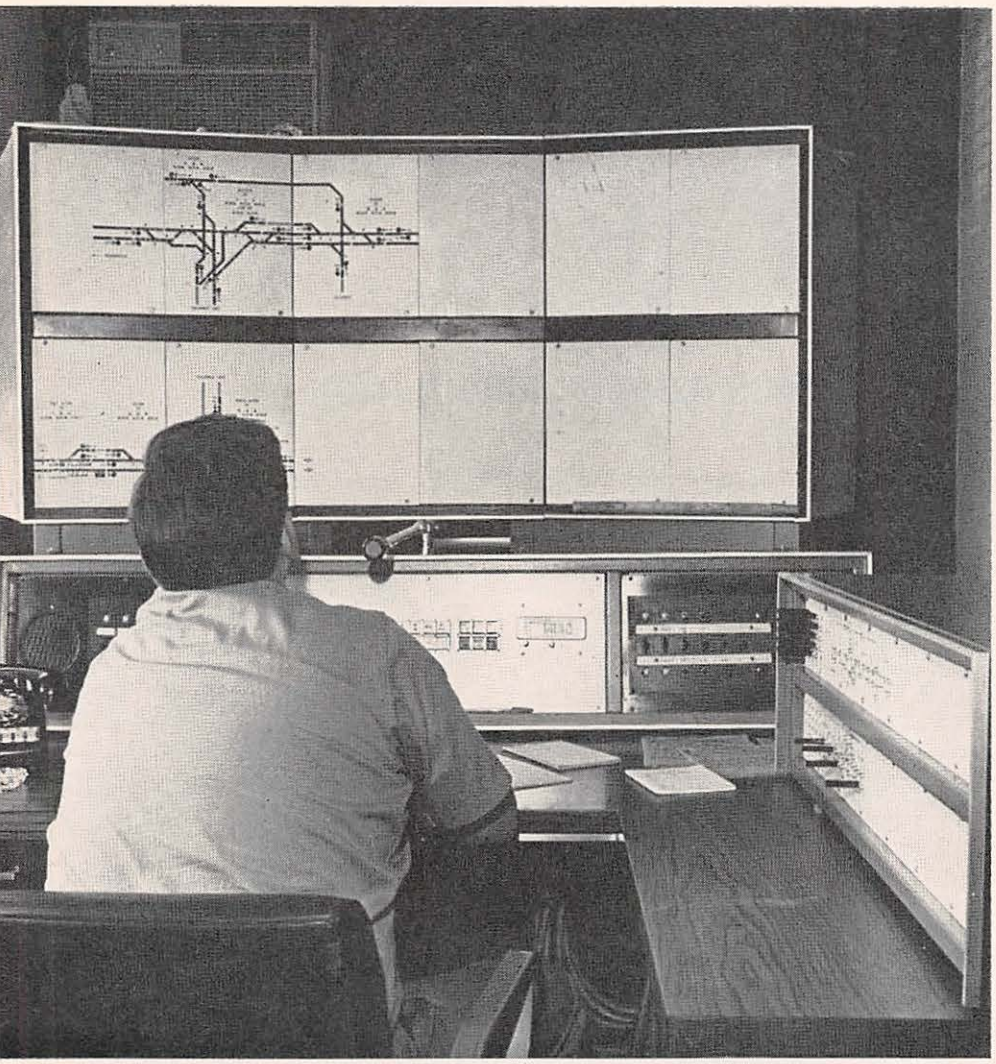
For PC, the improvement at Columbus terminal permitted the closing of four older and smaller yards. These yard closings, also permits the land to be available for urban redevelopment. Additionally, opening of Buckeye yard to service reduced work at two other major classification yards. Buckeye now does the St. Louis gateway blocking formerly handled at Avon yard in Indianapolis. Buckeye makes up blocks for Missouri Pacific, Cotton Belt (St. Louis Southwestern) and Alton & Southern. PC cabin cars (cabooses) run through to Pine Bluff, Ark. with the Cotton Belt blocks. Also, Buckeye does the blocking of cars for Selkirk yard (near Albany, N.Y.) formerly handled at Avon.

PC has a blocking and power pooling arrangement with Southern Railway. PC makes up blocks for Chattanooga, Tenn., and Atlanta, Ga., and for Cincinnati, Ohio where this PC-SOU train "OAC-7" is turned over to Southern. Cabin cars and power are run through from Columbus to Atlanta. The power pool consists of one PC diesel unit and three SOU units (including CofG).

Buckeye yard has 15-20 departing trains daily and 10-15 arrivals. This is just another way of illustrating that Columbus terminal originates more traffic than it receives. This keeps car distributors busy looking for empties, and which makes terminal control so vitally important. Centralization of paper work and car classification at Buckeye has reduced the congestion and delays at Columbus, and improved car supply for local industries because of the improved efficiency of the new yard.

An example of the improved efficiency is that in October 1969, before the new yard was in service, 72 engines worked the Columbus terminal (the eight yards and serving industry). In June 1970, 50-55 engines worked the same terminal and provided improved service. In addition to the general improvement in terminal operations, industry switching service has improved. For example, customers such as Westinghouse Electric and Transit Warehouse located near Buckeye yard have cars delivered directly from the yard. Formerly such deliveries were often made through an intermediate yard after first arriving in one of Columbus' receiving yards.

The improvement at Columbus terminal has enabled PC to improve service to other cities by means of adding new trains. For example, in April of this year, PC inaugurated 24-hour service between Selkirk and Buckeye, with one train in each direction making only five intermediate stops to drop off or pickup blocks of cars. Also, PC announced on June 15, that it was establishing a new freight train service from Chicago's 59th street yard to Buckeye yard that would save shippers up to 24 hr transit time. The new train "CO-8" leaves Chicago daily



BLOCK OPERATOR controls switches and signals at yard entrances.

at 9 am with stops at Dolton, Logansport, Marion, Bradford and Mounds, and arrives at Buckeye at 1:15 am the following morning.

Buckeye yard is an automatic retarder classification yard with a total car capacity of 4,510 with room for expansion. It is 4.5 miles long, 2,200 ft wide at its maximum point, with the hump 22.5 ft high. Acreage totals 453, and the yard has 88 miles of track. Prime contractor for the yard control system was General Railway Signal Co., who also furnished retarders, switch machines, signals and the twin process control computers, General Electric, GE/PAC 4020. Presently, 2500-3,000 cars daily are being classified over the hump crest.

There are several features in the operation of Buckeye yard that make for an improved operation. For example, trains arriving from the north have their switches automatically aligned for the proper yard receiving track when they occupy the yard track indicator circuit. Another feature enables receiving and departure yard car inspectors to directly inform the yard computer when inspections are complete by simply pushing a series of buttons located in a telephone booth near the inspection locations. The computer provides a report to the appropriate yardmasters that inspections are complete with identification of train and/or track numbers.

For the pull-back operation, that is, pulling cars from the classification yard and making them up into trains, the pull-back conductors sit in an elevated tower overlooking the pull-back tracks. From this elevated position, they can observe the operation while remaining in radio contact with their enginemen. Also, they remotely control the switches on the pull-back leads by means of a pushbutton control machine with a track model diagram.

The process control computers, not only provide automatic routing and retarder control, but are able to produce a series of reports for operation of Buckeye yard. The terminal DICCS (Demurrage and Industry Car Control System) is handled by the GE/PAC 4020 computer.

At present, the hump switch list is initiated by a clerk placing the proper class track card behind the car card and placing the deck of punched cards of cars to be classified into a card reader from which the computer prepares the switch list. It is planned that eventually the computer will prepare the switch list from a lookup table of class track designations.

Also, planned for future installation is automatic car identification scanners to be located at yard entrances. Also, a scanner could be located at the hump to provide a check of cars being classified.

The hump conductor has direct contact with the yard computer. His console contains pushbuttons for inputting data to the computer. Also, he has a cathode ray tube that provides four lines of information concerning cars being humped. For cars missing from the switch list, he can insert the class track designation at the time of humping, and after completion of this function, he can input data concerning car initial and number. Similarly, the hump conductor can cancel data on a car listed, but not in the cut or train being classified.

Another feature of this yard is the location of high-load detectors in approach to the master retarder. When the photocells of the detector are actuated, this information is inputted to the yard computer which will so indicate on the classification yard report containing cars on each class track. Also, the computer will determine if a car will clear the route restrictions of its assigned classification (destination of car beyond Columbus).

Five interlockings at the Buckeye yard connections to mainlines are controlled from a new block station located in the pull-back area. A feature of this interlocking control is a GRS 4000 high-speed code system operating at 2,000 bits per second that connects the Puleo Electronics control machine with the field locations. The control machine track diagram panel uses fibre optics to provide light indications. Light from one bulb can be distributed by fibre reeds or light tubes to several panel "dots" or locations.

One of the advantages of the GE/PAC 4020 twin computers at Buckeye yard is that they have the capacity to handle the humping operations and also handle the paper work so vital to the yard.

These and other features of this Buckeye yard will be described in more detail in a second article dealing with Penn Central's automatic classification yard at Columbus.

How one firm obtains label quality control

Computer Identics ties computer usage into its ACI label assembly program to obtain quality control over production.

As the January 1, 1971 deadline approaches for having the railroad freight car interchange fleet equipped with automatic car identification labels, the realization is dawning that ACI scanners should be installed to read these cars. At the present time over 85% of the fleet is labeled. As for accuracy, the best evidence points to upwards of 95% correct readings from scanners.

One obvious means of obtaining greater accuracy is to have freight cars and other rolling stock correctly labeled. Several railroads, trailer and container manufacturers, operators of TOFC/COFC leasing systems, freight car and locomotive builders have turned to firms such as Computer Identics Corp. to provide complete assembled ACI labels.

CI, at its Westwood, Mass. plant, normally turns out 1500 label sets (2 labels per set) per month with two assemblers working a 40-hour week. Increased production can be obtained by adding a third assembler or working two or three shifts per day, says John J. Manton, manager, transportation control materials. Labels are assembled on aluminum or steel plates or vinyl backing, according to customer requirements. New freight cars and locomotives usually are equipped with vinyl backed labels. For trailers and containers, label plates must be of the same metal as the "box" to prevent interaction of dissimilar metals that may be corrosive. The same would apply to using metal plates on rolling stock, says Manton.

A significant feature of CI's label assembly program is the use of a computer to calculate the check digit, a scanner to check label assembly and providing a computer printout for the customer to verify the correctness of the assembled labels. The computer printout is generated by the label after assembly. Therefore, it indicates exactly what the label says. After verification by the computer printout, a small CI checkmark with the word "verified" and the date of such verification is attached to each complete label. Not only does this indicate that the label is correct, but the date can be meaningful as an indicator of service life, says David J. Collins, CI president.

The overall operation of the label production system is designed to guarantee complete accuracy in label making operation. Orders received from a customer are entered to the central PDP8/I computer. The computer calculates the parity and prints two label stickers; one for each label of a car set.

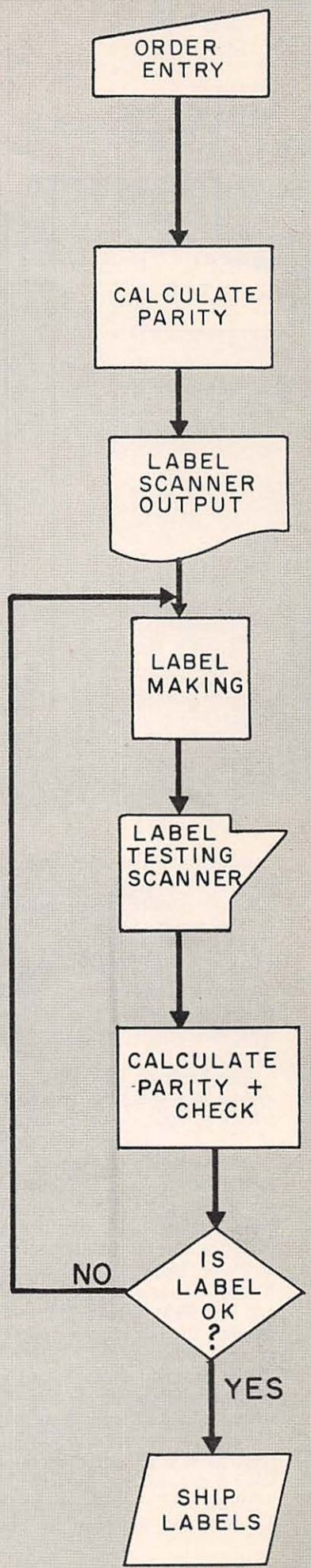
The label stickers contain the word "TOP" to designate the top of the label, the car initials and the full number of the label to be made including "start", "stop", and calculated parity.

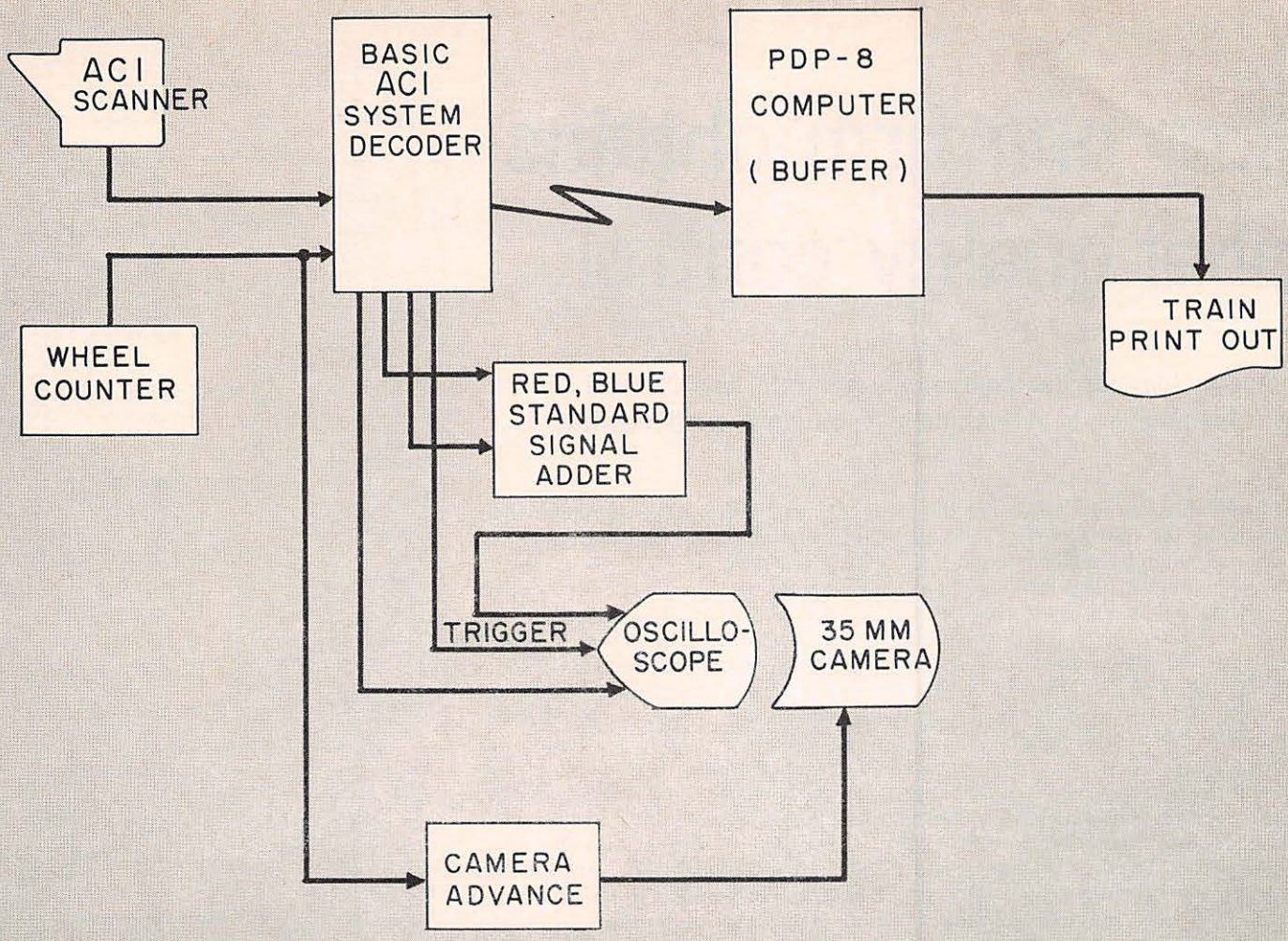
These stickers are batched in groups of 25 car sets and are given to trained personnel who make the labels using the stickers as work sheets. As each label is assembled, the sticker is permanently stuck on the backside top of the label. This is done to identify the top of the label so that people applying them in the field can readily check which side is up. In addition the sticker has the car initials and number to serve as a final check before application.

The batch of 25 car sets is then taken to the label inspector who sequentially feeds them to the label testing scanner. The scanner, of course, will feed color coded signals to the PDP8/I computer which checks the label to determine that no error was made in assembly or no error is made through the use of false printed label stripes.

If the label is correct, a real-time report is generated giving the number of the label including start, stop, and parity. On the other hand, if a label is wrong a real-time report is generated giving the numbers of the label including start, stop, parity, and the word ERROR printed next to it. In addition the computer will ring the teletype bell which will alert the supervisor on duty.

After all the labels have been tested, any labels that need correction are





corrected on the spot and are feed back to the label tester for recheck. The corrected labels are printed below in the report under the heading of "ASSEMBLY ERROR CORRECTIONS". The inspector then initials the reports and sends the label and report to shipping. The batch of labels with the report are then shipped to the customer.

The heart of CI's label production system is a specially designed scanner which is used to optically scan each of the 52 reflective sections of the label. Each label is made up of 13 module stripes, and each stripe is made up of two parts. Since each part may have red or blue reflective material (white is the combination of both red and blue, black is the absence of both) it must be viewed by independent red and blue light sensors. Thus each stripe requires the use of four optical sensors or photocells.

The scanner is made up basically of 26 (one for each section of a label stripe) miniature optical pick-up units. These units are strategically placed to scan each label stripe section as the label is slid into the scanner.

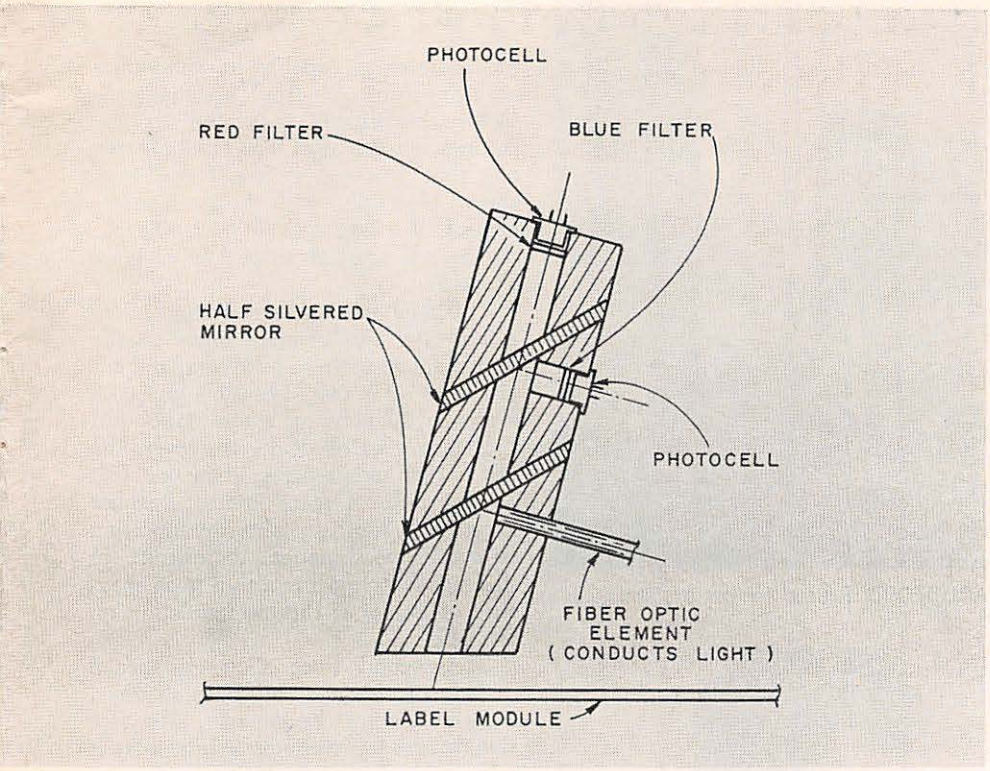
When a label is placed on the scanner and slid into reading position a Xenon lamp is ignited. The light generated by the Xenon lamp is picked up and conducted to each section of each label stripe by the use of 26 fiber optic elements. The light emitted by the fiber optic elements is reflected by the lower half-silvered mirror onto the sections of the label stripes. As each stripe section gets illuminated it will reflect red, blue or white light. If the section is black no light will reflect. The reflected light will pass through the lower half-silvered mirror and strike the upper half-silvered mirror. The upper half-silvered mirror will reflect half the light and pass the other half. To detect the light that is now separated into two paths, a combination of red and blue filtered photocells are used. Thus, if the stripe section was red, only the red filtered photocell will produce a signal; if the stripe section was blue, only the blue filtered photocell will produce a signal; if the stripe section was white, both photocells will produce a signal; and if the stripe section was black, neither photocell will produce a signal.

The signals are then fed to amplifiers which in turn feed into the PDP8/I computer which analyzes the signals and determines whether an error condition exists.

Successful implementation of ACI requires a study to determine both short and long range usage. With a background of considerable experience in ACI applications, Computer Identics has been instrumental in developing complete system plans for implementing ACI, especially for terminal con-

MANAGEMENT INFORMATION

One of the key elements in the automatic car identification program is the label on the car. Assembly of a complete label must include correct alignment and arrangement of the digit modules. Also, the correct parity check digit must be applied. To insure that the parity digit is correctly calculated and label assembly is correct, Computer Identics uses a computer for check digit calculation and an inspection of the final assembled label.



ACI LABEL TESTER optical box is a specially designed scanner.

SPECIAL UNITS USED FOR CONTROLS

TEST SITE SYSTEM provides statistical data for evaluating ACI.

COMPUTER IDENTICS CORPORATION
SOUTHWEST PARK
WESTWOOD, MASSACHUSETTS 02090

THIS INSPECTION RECORD SHOWS ACTUAL LABEL READINGS OBTAINED FROM THIS LOT OF LABELS ASSEMBLED FOR YOU BY CI. IT IS YOUR ASSURANCE OF THE ABSOLUTE ASSEMBLY ACCURACY REQUIRED BY THE ACI PROGRAM. RETAIN THIS RECORD IN YOUR FILES.

TEST LABEL: ST 0 123 456789 SP 10*

ST 0 712 190279 SP 9	ST 0 712 190279 SP 9
ST 0 712 190278 SP 3	ST 0 712 190278 SP 3
ST 0 712 190277 SP 8	ST 0 712 190277 SP 8
ST 0 712 190276 SP 2	ST 0 712 190276 SP 2
ST 0 712 190275 SP 7	ST 0 712 190275 SP 7
ST 0 712 190274 SP 1	ST 0 712 190274 SP 1
ST 0 712 190273 SP 6	ST 0 712 190273 SP 6
ST 0 712 190272 SP 0	ST 0 712 190272 SP 0
ST 0 712 190271 SP 5	ST 0 712 190271 SP 5
ST 0 712 190270 SP 10*	ST 0 712 190270 SP 10*
ST 0 712 190269 SP 6	ST 0 712 190269 SP 6
ST 0 712 190268 SP 0	ST 0 712 190268 SP 0
ST 0 712 190267 SP 5	ST 6 712 190267 SP 5 ERROR
ST 0 712 190266 SP 10*	ST 0 712 190266 SP 10*
ST 0 712 190265 SP 4	ST 0 712 190265 SP 4
ST 0 712 190264 SP 9	ST 0 712 190264 SP 9
ST 0 712 190263 SP 3	ST 0 712 190263 SP 3
ST 0 712 190262 SP 8	ST 0 712 190262 SP 8
ST 0 712 190261 SP 2	ST 0 712 190261 SP 2
ST 0 712 190260 SP 7	ST 0 712 190260 SP 7
ST 0 712 190259 SP 3	ST 0 712 190259 SP 3
ST 0 712 190258 SP 8	ST 0 712 190258 SP 8
ST 0 712 190257 SP 2	ST 0 712 190257 SP 2
ST 0 712 190256 SP 7	ST 0 712 190256 SP 7
ST 0 712 190255 SP 1	ST 0 712 190255 SP 1

ASSEMBLY ERROR CORRECTIONS:
ST 0 712 190267 SP 5

COMPUTER PRINTOUT goes with ACI labels to each customer.

trol, says James Anderson, manager, transportation control systems. CI is working with Intermodal Transportation Systems, Inc., on a terminal control system for Illinois Central at its intermodal exchange in Chicago which is a key TOFC/COFC terminal.

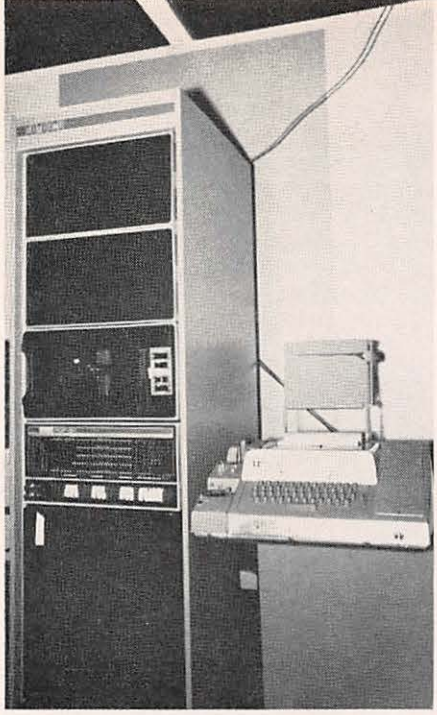
To insure the success of these TOFC/COFC terminal systems, CI and ITS have established an ACI test site on the Penn Central line in Westwood, Mass. The test site makes use of a basic ACI system which is interfaced directly to a Digital Equipment Corp. PDP/8 computer, which acts as a buffer and data concentrator to output the train consist on a model 33 Teletype printer.

The purpose of the site is to gather label statistics, system performance statistics, and "hands on" experience with the latest equipment. Data gathered includes number of cars recorded past scanner, number of labels read and not read, number of labels past the scanner, number of labels with incorrect parity and number of labels physically damaged.

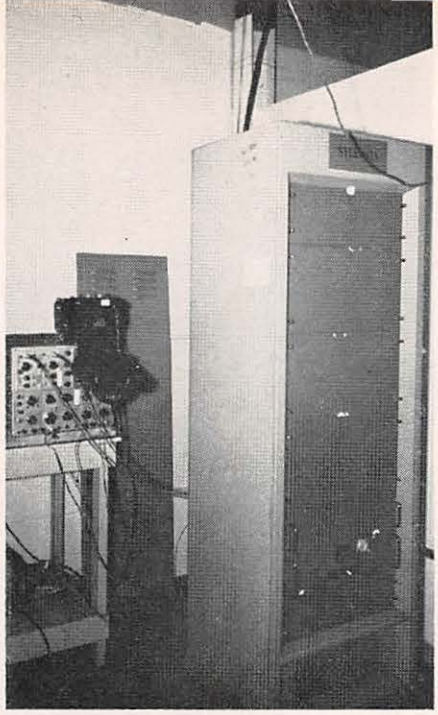
To avoid the need of physically examining every train the site is instrumented with a Tektronix model 545 oscilloscope and a 35mm sequence scope camera capable of holding 100 ft rolls of film. The process results in having a picture frame for each car and pictures of the scope traces resulting from labels that are on the cars. The analysis and correlation of the film with the print-out yields label statistics.

Chris B. Kapsambelis, vice-president, engineering, describes the operation of the system. System operation involves the use of the wheel counter circuitry to open the camera shutter on the first wheel of each car and close the shutter on the fourth wheel of each car. Thus the camera will record any signals that might result from a label on the car. When the shutter is closed, the camera will advance the film one frame and be ready for the next car. If no signals are recorded from a label then the car is assumed to be unlabeled.

In order to record on film labels that fail to "read" on the Teletype, the instrumentation provides for the use of circuitry to detect a label "start" or "stop" code entering the decoder and uses this signal to trigger the scope. This represents the minimum requirement for a label whereas the decoder, to insure accuracy, demands that both start and stop signals be present in their respective positions. The scope trigger sets up a time function delay which is timed to generate a scope trace coincident with the next scan data arrival from the scanner. Since



COMPUTER used in quality check.



ACI DECODER used in test system.

ASSEMBLED LABEL is moved into tester optical box in quality check.

LABELS can be assembled at rate of 1500 sets (2 labels) per month.

the scanner is capable of generating multiple scans of a label, a scope trace shows the signals generated by the scanner, on the scan directly following one that detected a "start" or "stop" signal. Generally, with the possible exception of a train traveling at 80 mph, the second scan of a label is as good as the first.

The dual trace scope is attached to display the blue channel signal on the upper trace with a scale reading adjustment of 1 volt/cm. This signal is typically 20 volts on a new label and the trace goes off scale. However, the labels that measure less than one volt are the ones of great interest because they could indicate label deterioration or system malfunction. A measure of this signal strength is also a good measure of excessive dirt accumulation on the label.

The second trace shows a special display of the red and blue standard signals entering the decoder. The two signals are fed through a blue biased adding circuit which displays the "color" of the scanned label by noting the negative level excursion of the waveform.

When the waveform is at level 0 the scanner is scanning black, level 1 when it is scanning red, level 2 when it is scanning blue, and level 3 when it is scanning white; thus the color code of the label can be detected and decoded into the number of the label even though the Teletype failed to print a number and printed 12 zeros denoting "no label". A true label picture can now be reconstructed and correlated with the print-out to develop label statistics.

Even though it is theoretically possible for a label to have both the "start" and "stop" missing or unreadable, we have as yet not encountered any condition where a car was labeled and no picture has resulted. Trains that go by in the daytime are spot checked by someone noting the labeled cars on a tape recorder which is later played back and correlated with the print-out.

"We therefore believe these statistics to be as accurate as any that are obtained by making physical checks of the train.

"In addition to the accumulation of statistics the film recording process yields sufficient data to detect even the most subtle failure modes of ACI and corrective action can be taken to improve its overall accuracy. We have high expectations that these studies will yield knowledge to vastly improve the reliability and accuracy of future ACI systems," Kapsambelis says.

Microwave uses pcm

BY T. R. HAGGAR
MANAGER, MARKET RESEARCH
TELECOMMUNICATIONS DIVISION
CANADIAN MARCONI CO.

Since the beginning of time, man has forged ahead in exploration of his environment. All his feats from the simplest to the most complex have depended upon his ability to communicate. Communication, whether by runner, pigeon, smoke or electronics, has always stayed ahead of technological advances in other fields.

In the railroad industry—especially during the last 100 years—communications have been strained to stay one step ahead of rolling-stock technology. Today railroad communication must not only be the vanguard for technology but provide efficient service in keeping freight moving in the right direction at minimum cost. To do this, railroad communication must channel the capabilities of the computer and become an effective, economical carrier of the mountains of data the computer processes.

Railroad technology is becoming increasingly dependent upon the computer. More and more railroads are installing ACI (Automatic Car Identification), TRAIN (Tele Rail Automated Information Network), and UMLER (Universal Machine Language Equipment Register). All of these systems depend upon the computer. The question is—can the communications systems in use handle the data explosion efficiently and economically?

Since 1950, microwave communications have grown from a few thousand route miles to over a million route miles of operating communications systems in North America. This growth was somewhat slowed by the expense of microwave communications but the introduction of solid state devices has considerably reduced hardware costs. Nevertheless, other costs associated with these systems—towers, no-break power sources, etc.—are still quite high, causing some industry spokesmen to say, "Why pay out large sums of money for new systems when aerial wire is still available?"

As the use of the computer increases, aerial wire has to be conditioned to accept the digital output of the machine, with attendant increase in costs. The use of digital equipment is not new to railroads; Teletype has been in use for many years—but even this relatively simple machine must change its digital output to a frequency via a "frequency shift keyer" before the signal can be transmitted over any type of Frequency Division Multiplex (FDM) system, whether cable or microwave.

Many microwave and cable systems in use today were designed and developed a decade or more ago. They rely upon analog techniques which require frequent maintenance. Very few systems can handle voice and data equally well. If the system is optimized for voice, it has to be conditioned for data. If it is optimized for data, it is expensive to use for voice communication. Moreover, since FDM is an analog system, an analog-to-digital and digital-to-analog converter must be placed at each end of the system. These converters are complex and expensive.

Bearing these points in mind, it is obvious that systems must be optimized in such a way that they will not choke on the vast amount of information that has to be handled every day of the year. And an effective, economical system must handle both voice communication and data efficiently.

Canadian Marconi has developed a new microwave (PCM) system—MCS 6900—which meets these objectives.

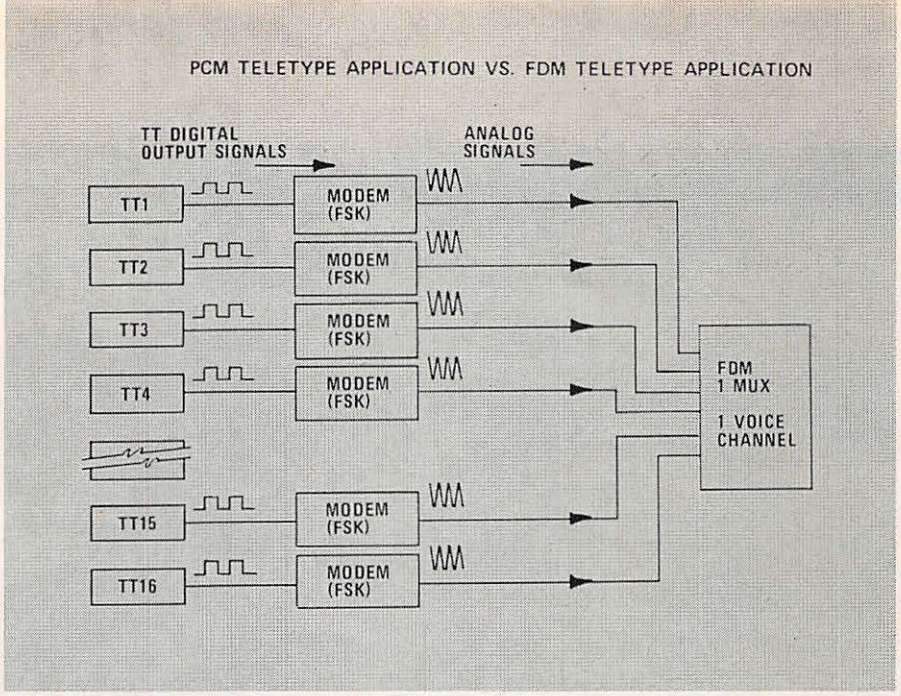


FIGURE 1—Teleprinter circuits using frequency division multiplex.

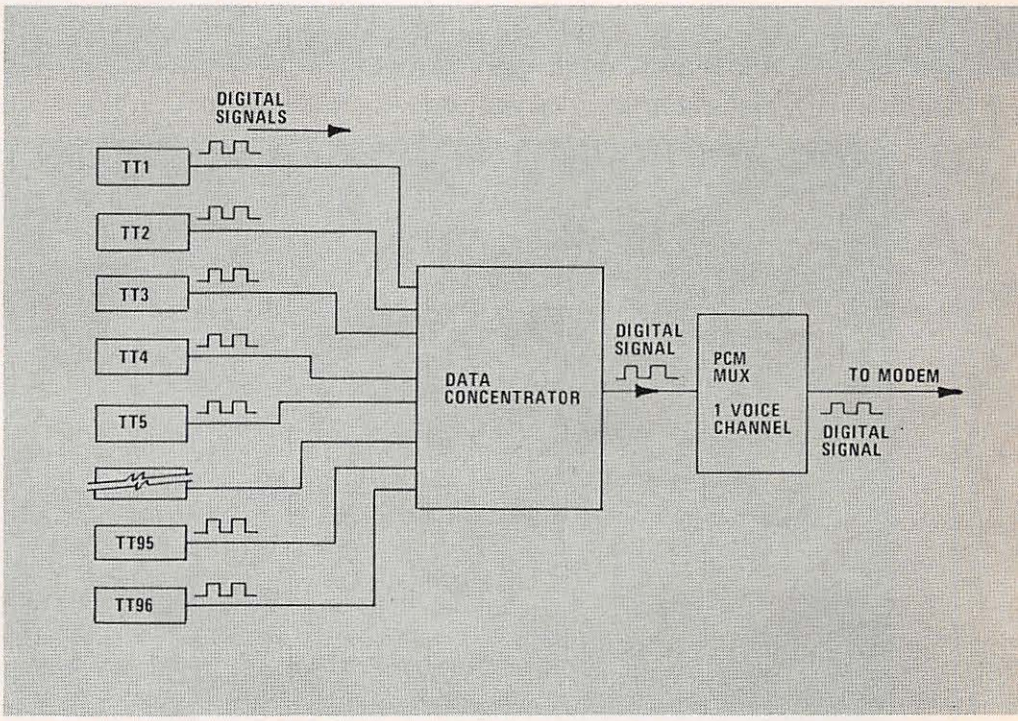
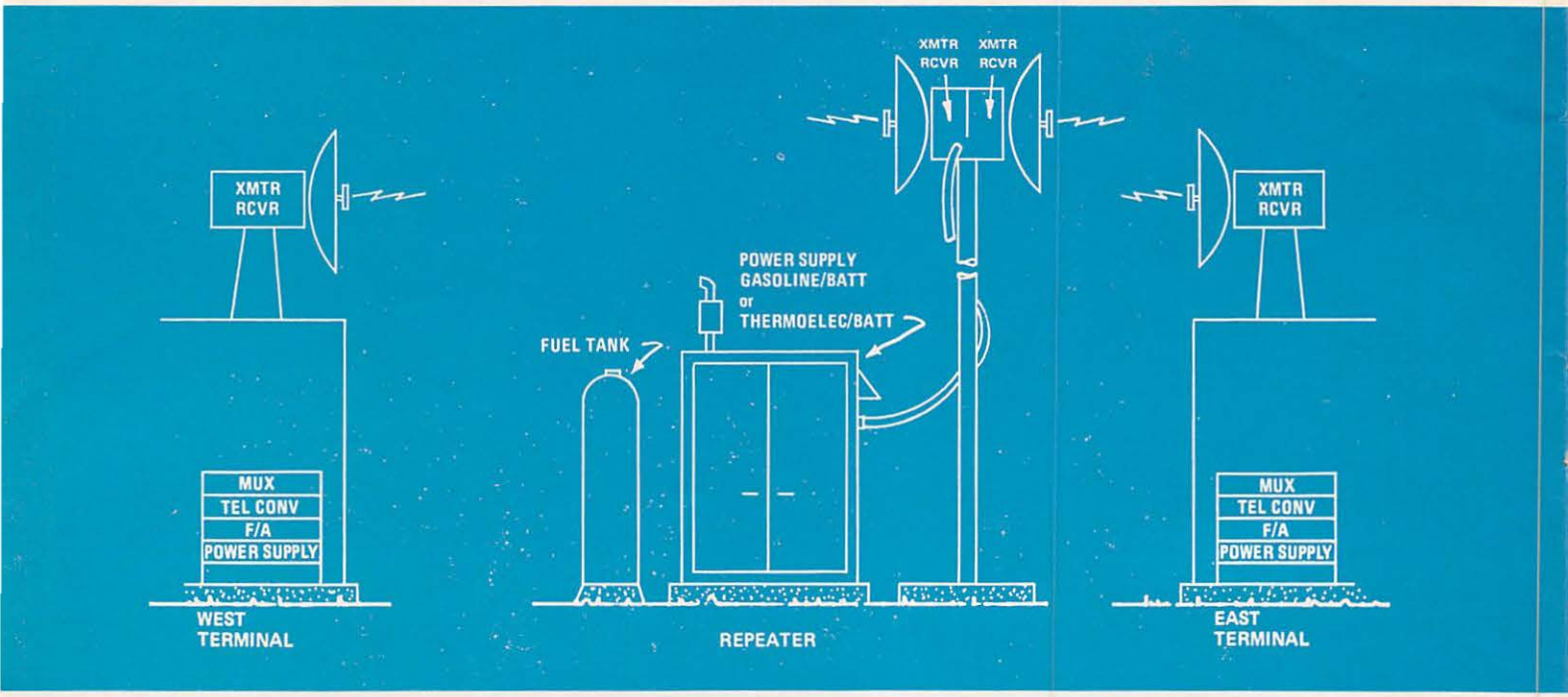
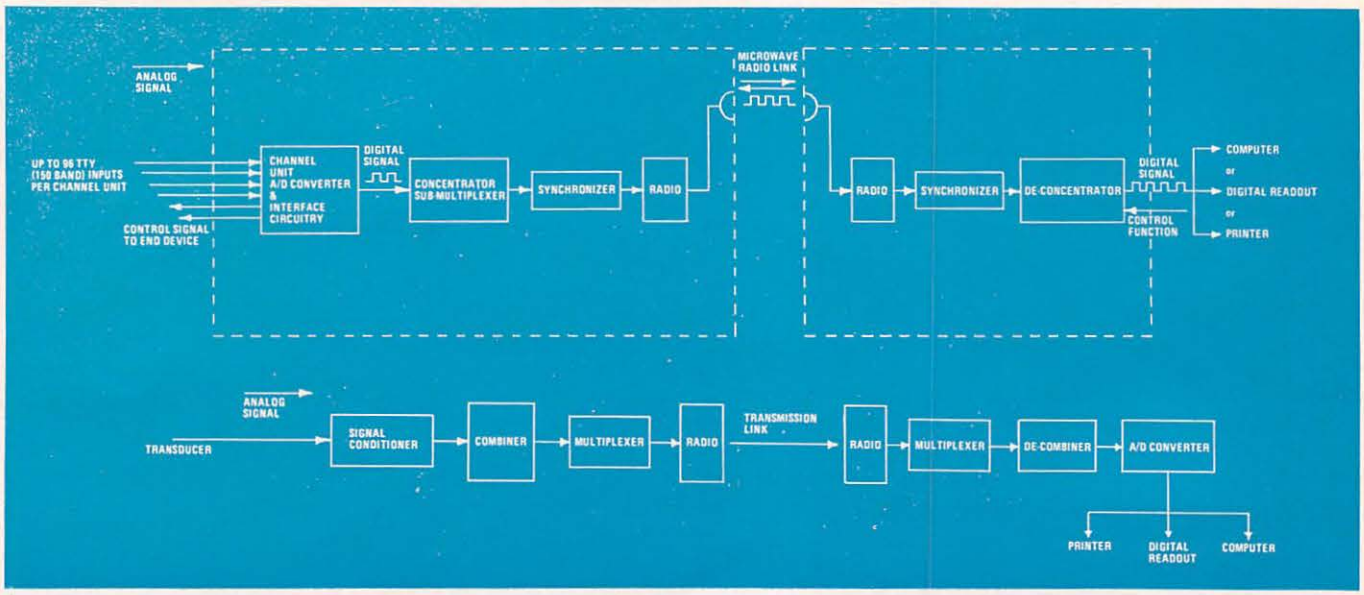


FIGURE 2—Teleprinter circuits operating on pulse code modulation.



TYPICAL CONFIGURATION of the MCS 6900 pulse code modulation microwave system.



PCM MICROWAVE radio relay system (above) and frequency division multiplex microwave is below.

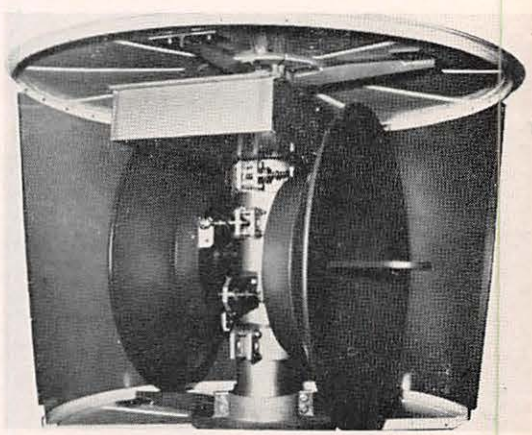
Although the theory of Pulse Code Modulation has been common knowledge for many years, it has only become more widely used with the development of integrated circuits.

PCM has been used on cable systems, notably T1, for a number of years. However, only the military has been using PCM over radio in North America to date. A main argument against PCM has been the large bandwidth required to transmit over radio. Techniques such as duobinary, ternerary, quaternary and Delta Modulation have been developed to partially overcome this problem. In the foreseeable future this problem will no longer exist.

Let us consider a teletypewriter application and the units which are required. Figure 1 shows the FDM application: 16 teleprinter channels utilizing 1 voice channel.

Each teleprinter machine requires a modem which converts the teletypewriter on/off signal to an analog frequency; the modem is a transmit and receive device which costs approximately $200-$500. In an average case, total modem cost for 16 teleprinter channels would be about $4,800.

Now consider the MCS 6900 PCM case as shown in Figure 2, with 96 teleprinters using 1 voice channel = 19.2 Kbits. The approximate cost of the digital concentrator combining the 96 teleprinter channels saves approxi-



MASTHEAD UNIT is for microwave.

Pulse Code Modulation-FM	Frequency Division Multiplex-FM
NOISE PERFORMANCE	
Independent of system length.	Accumulated with distance.
Independent of received signal.	Dependent on received signal.
Performance limited by design of non-critical modem and selection of basic code.	Performance variable and dependent on intermodulation and thermal noise levels.
	Requires high quality components and rigid design.
Insensitive to interference.	Sensitive to interference.
"Sudden death" noise performance.	"Graceful degradation" up to threshold.
VOICE QUALITY	
Quantizing noise and distortion dependent on voice level.	Noise dependent on RF signal level and intermodulation products.
Dynamic range limited by choice of basic code.	Large dynamic range—limited by amplifier distortion.
Identical performance on all channels—time sharing.	Variations between channels—frequency sharing.
DATA TRAFFIC (Including signaling and supervisory)	
Direct digital access to pulse stream—efficient use of capacity.	Digital/analog and analog/digital conversions required—inefficient use of traffic capacity.
SYSTEM CAPACITY	
No reduction in system capacity for data traffic.	Equivalent loading reductions required for data traffic.
BANDWIDTH AND POWER	
Full modulation capabilities are allocated to each time slot.	Modulation capabilities are shared in proportion to relative levels and frequencies of channels.
CIRCUITRY	
Low power/large bandwidth.	High power/small bandwidth.
Less than 20 db carrier/noise required.	Greater than 40 db carrier/noise required.

mately 50% over FDM.

The flexibility of the system shown above also allows up to eight 2.4 Kbit asynchronous data streams to be transmitted over a single voice channel or a mix of teleprinter and medium speed data up to a maximum of 19.2 Kbits of asynchronous data over one voice channel.

These examples indicate at least a 3:1 data capability advantage for MCS 6900 PCM system over an equivalent FDM system. Another plus: the system allows a single high speed 50 Kbit data stream to be passed over one voice channel without interfering with adjacent channels.

The net effect is greater utilization of available spectrum occupancy and channel capacity. Also, the digital approach allows the user to expand the facility to the maximum without purchasing additional modems whenever a teletype channel is added.

One question frequently asked is "But we have an FDM system which is X years old. We wish to expand it to handle data traffic. How can PCM help?"

Let us assume that a railroad has an FDM system which is seven years old, and fully-loaded with voice, data, and teleprinter. The plan is to install a new parallel system, thereby doubling the capacity.

Since data transmission requires an ultra reliable carrier, where the effects of fades and other interference are minimized, the PCM mode more than adequately fulfills this requirement. Therefore, the plan can be formulated in such a way that all data is carried by the new PCM system and the voice transmissions are carried by the old FDM system. It is possible to carry 96 teleprinter channels over one voice channel, without the expensive use of FSK (Frequency Shift Keyer); it is also possible to carry eight 2.4 Kbit pulse trains over one voice channel. To illustrate: the MCS 6900 can handle 960 teleprinter circuits over 10 voice channels and eight 2.4 Kbit data streams over 10 voice channels—a considerable saving in channel capacity compared with an FDM system. As for initial hardware costs, the MCS 6900 system will cost approximately 50% less than the equivalent FDM system, and no investment is required for expensive data concentrators and special conditioning of circuits.

An argument can be advanced that the PCM equipment will, like FDM equipment, become old, with similar increases in maintenance costs. This is only partially true. It will, of course, become old, but maintenance costs will not increase at the same rate as other systems. Why? With solid state there is no degradation of operating characteristics. If the circuits in which they are used are designed correctly, they will retain their operating characteristics indefinitely. Repairs, when needed, are minimized by limiting technician activities to replacement of throwaway modules.

The throwaway concept tends to make people a little scared because it involves money. The answer to this is, if a board containing five circuits is designed in such a way that a new replacement cost is about $20, is it worthwhile keeping expensive test equipment and highly skilled technicians to replace a component which costs $1.50? Obviously, it is not. Moreover, the skilled technician can be better utilized if he is released to apply his talents elsewhere in the maintenance of the FDM system.

New PCM systems have been designed in such a way that modifications can be readily applied at minimal cost as and when economics and technology dictate. Therefore, the user can always have state-of-the-art equipment.

With solid state components reducing in price and as technology advances, the users of PCM are guaranteed a rugged reliable system which will lower installation and operating costs and keep pace with his communication needs as an organization expands. PCM-on-radio, the latest of man's communication achievements, will carry the data load of the future.

For Microwave Communications, You Can't Beat This Combination –

For voice communication, the Lynch solid state B910B single side-band suppressed carrier multiplex–reliable, compact and flexible–is ideal for new microwave multiplex applications and for modernizing existing systems. The B910B provides typical Lynch optimum transmission quality and can be custom tailored, both electrically and in rack profile. As an example, there is almost an unlimited variety of frequency allocation plans to suit your particular requirements.

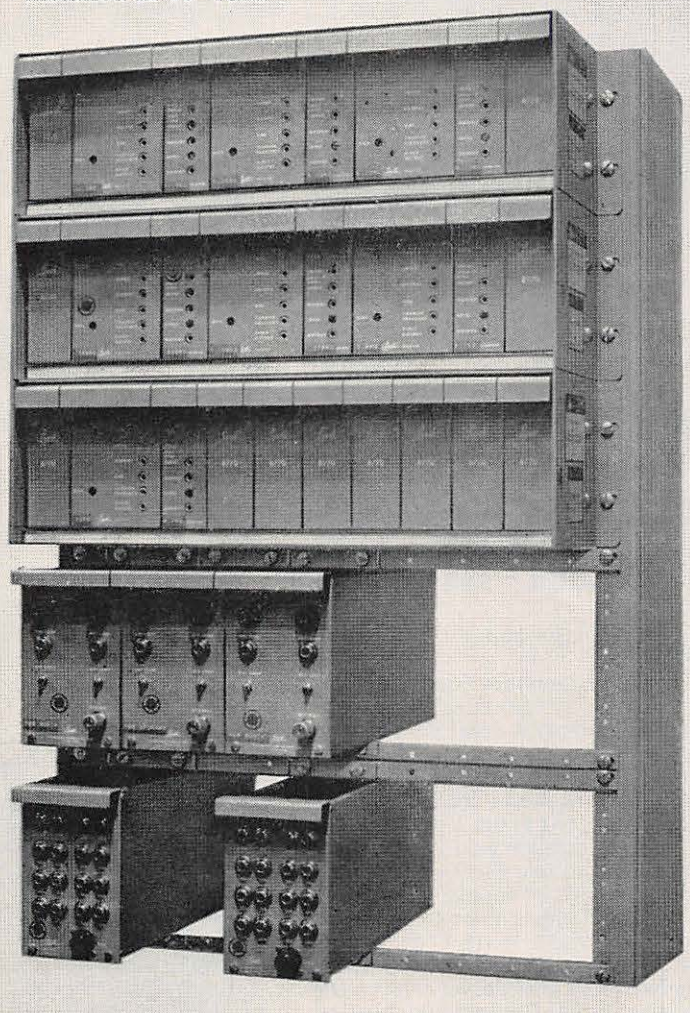
The Lynch B770 tone carrier equipment is an ideal combination to be used with the B910B. The B770 is insensitive to noise and phase variations. Reduction of bias distortion and minimization of false operation due to spurious signals are provided by this frequency-shift type of equipment. Reliability is further enhanced by the 35 db (minimum) adjacent channel receive filter rejection which reduces crossfire, crosstalk, and noise to a minimum. The B770 is a superior device for telemetry, telegraph, supervisory control, monitoring and alarm reporting.

Lynch products are easily adaptable to your present or proposed system and are fully compatible with the best industry standards. As with all Lynch equipment, the B770 and the B910B are backed by an undisputed record of top quality and service.

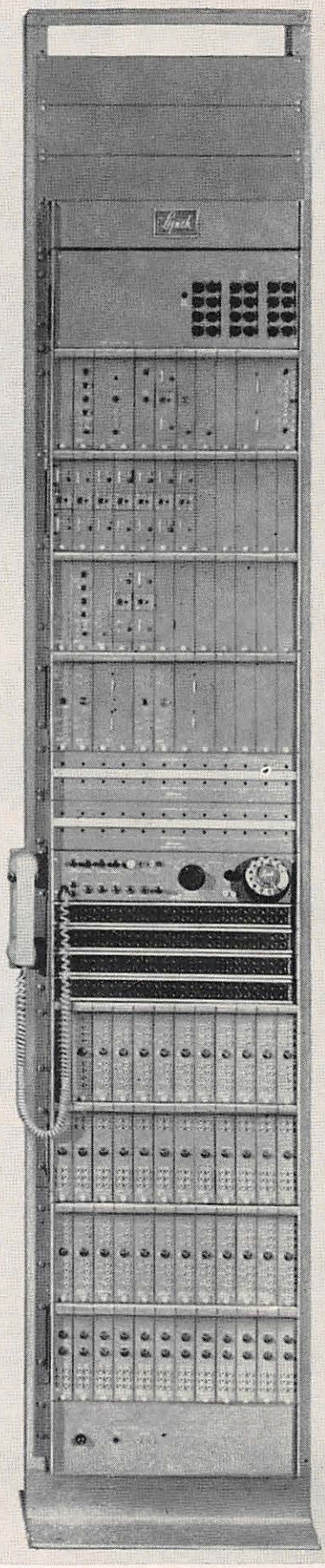
For any communication problem, talk to a man that speaks your language–the Graybar Communication specialist. You can get in touch with him through one of over 140 Graybar offices.

Go to the source: GraybaR

LYNCH B770
installed in 19″ rack

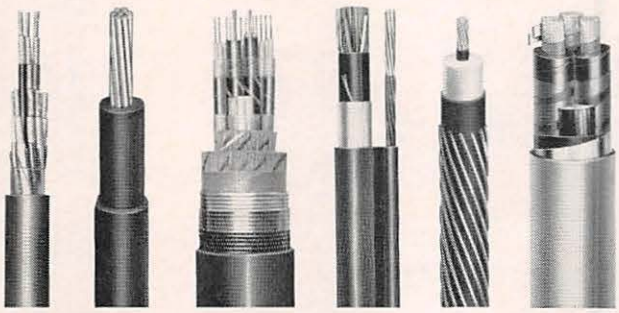


LYNCH B910B
installed in 19″ rack



Circle 40 on reader service card

We've been working on the railroad.



General Cable has been a major supplier to the railroad industry since 1882.

We supply a full line of communications wire and cable. Coaxial cables. Control and signal cables. Power cables. Trolley wire. And we supply a great deal of supporting equipment as well. Like support hardware for Figure 8 Wire and Cable, Cross Over Clamps, Suspension Clamps and other cable support items from Diamond. Cable pressurization equipment from Puregas. Tie splints, transposition brackets, galvanized Line Wire and galvanized Guy Strand from Indiana Steel and Wire.

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General Cable

SPECIAL REPORT

AAR COMMUNICATION AND SIGNAL SECTION

San Francisco Hilton
September 15-17

AAR DATA SYSTEMS DIVISION

Regency Hyatt House,
Atlanta
September 28-30

- Programs
- Exhibits
- Product Showcase

A service
by the
Simmons-Boardman
Railway Age
Group

Communication & Signal Section Program

San Francisco Hilton Hotel, Sept. 15-17, 1970

Tuesday Sept. 15: Imperial Ballroom

9:00 a.m.—**Address:** R. D. Spence, Vice-President Operations, Southern Pacific.

Address: M. B. Mitchell, Director, Office of High Speed Ground Transportation, Federal Railroad Administration.

Reports: Committees A through G.

Wed., Sept. 16: Imperial Ballroom

9:00 a.m.—Introductions by C. J. Nelson, Second Vice-Chairman, C&S Section.

Report: "Interconnection Tariff," by R. J. Maher, Marketing Supervisor, American Telephone & Telegraph Co.

Paper: "Integrated Circuit Technology and Its Application in Mobile Communications Equipment," by Dr. Theodore Saltzberg, Product Manager Common Carrier Products, Motorola Communications & Electronics, Inc.

Paper: "Telegraph Transmission Over Pulse Code Modulation Systems," by C. G. Webster, Chief Engineer Telecommunications, Canadian National.

Discussion: "Remote Control of Slave Locomotives by Radio," C. O. Jett, Superintendent Communications, Union Pacific.

Wed., Sept. 16: Hilton Plaza

9:00 a.m.—Introductions by R. D. Liggett, First Vice-Chairman, C&S Section.

Paper: "A New Approach to Crossing Signals," by Victor L. Lindberg, Scientific Research Staff, Ceramics & Glass, Ford Motor Co.

Paper: "Railroad Electrification —Its Effect on Signaling and Communications," by G. E. Stinson, Manager Engineering, Signal & Communications Division, WABCO.

Paper: "Relay Code Systems vs. Solid State," by Henry C. Sibley, Research Engineer, General Railway Signal Co.

Discussion: "PMC," by representatives of Marquardt Industrial Products Co., Rock Island Lines, and Southern Pacific.

Thursday Sept. 17: Imperial Ballroom

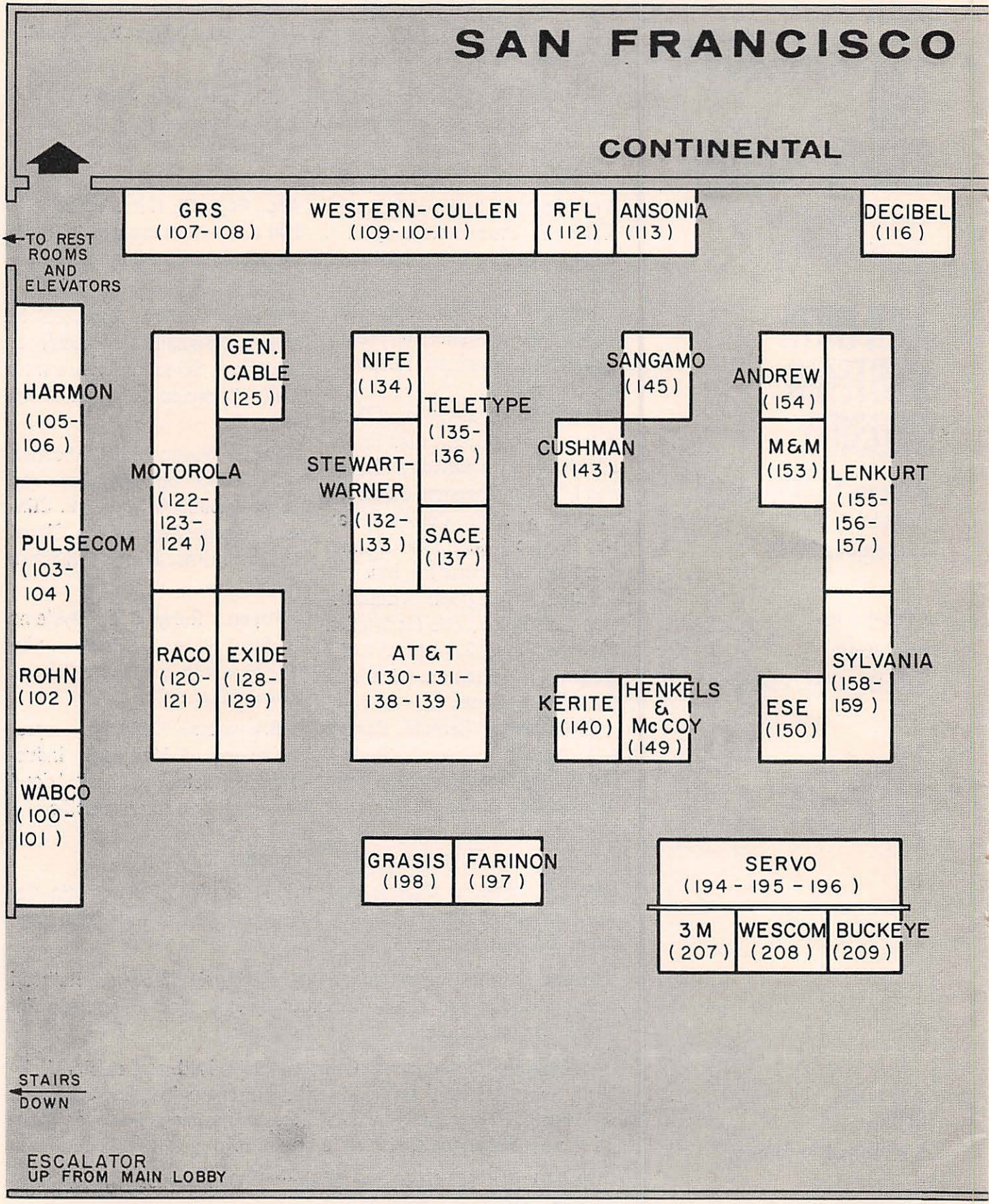
9:00 a.m.—Paper: "Status, Use and Reliability of Automatic Car Identification Scanners," by J. H. Seamon, Senior Industrial Engineer, Missouri Pacific.

Paper: "Status Report on HVDC on Actual Effects on Railroad Communication and Signal Circuits," by R. J. Berti, Electronic Engineer, Union Pacific.

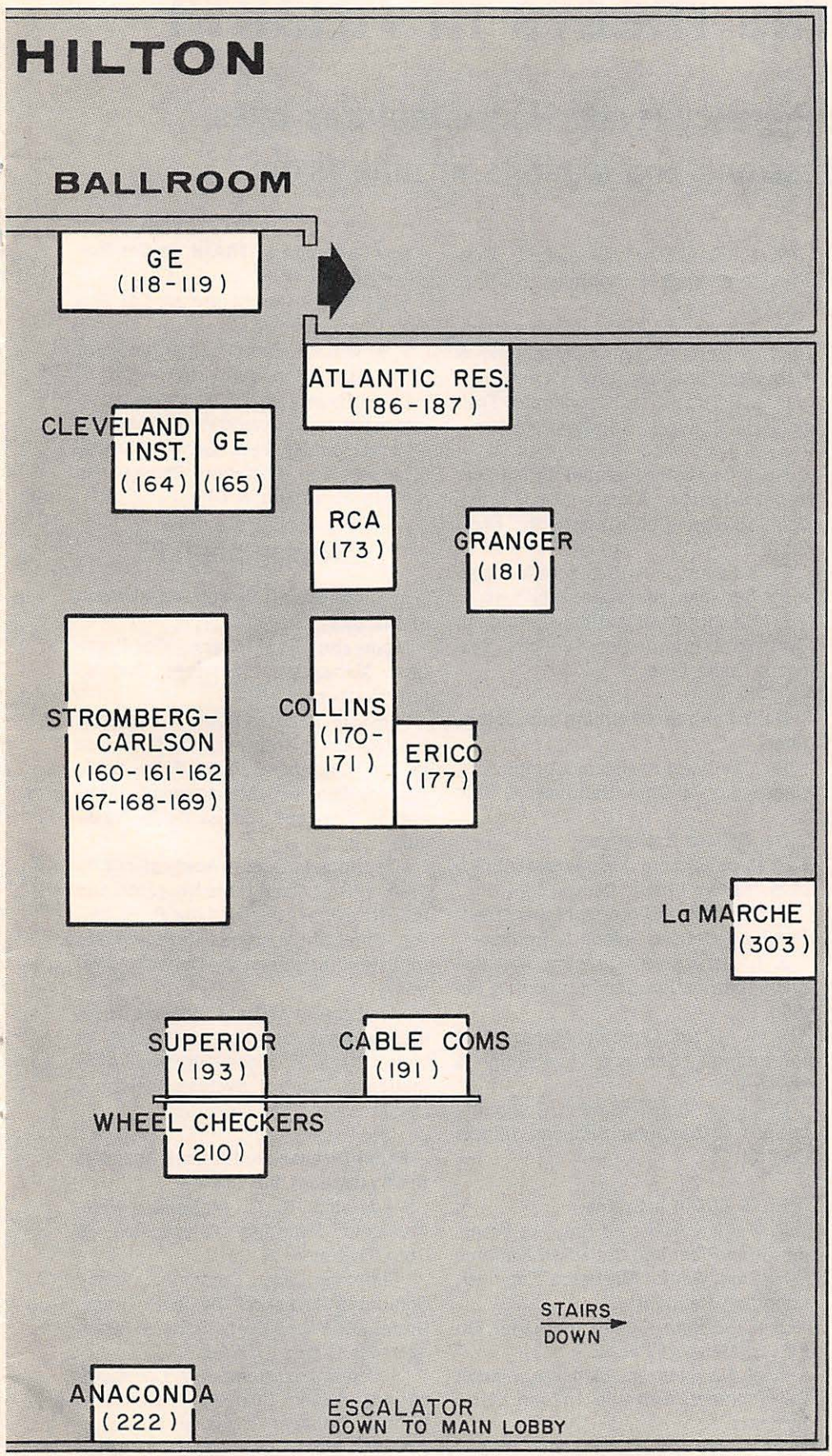
Discussion: "Information Garnered from Hotbox Detectors," by N. C. Pace, Assistant to Vice-President Communications, Southern; and "Hotbox Detectors," by J. M. Hesser, Assistant Manager, Communications & Signals, Norfolk & Western.

Remarks: J. N. Albertson, Chairman, Communication & Signal Section, AAR.

Exhibits of 46 firms will be on



display at C&S annual meeting



EXHIBITORS & (BOOTHS)

Ansonia Wire & Cable Co. **(113)**
American Telephone & Telegraph Co. **(130-131, 138-139)**
Anaconda Wire & Cable Co. **(222)**
Andrew Corporation **(154)**
Atlantic Research Corp. **(186-187)**
Buckeye Telephone & Supply Co. **(209)**
Cable Communication Systems **(191)**
Cleveland Institute of Electronics **(164)**
Collins Radio Co. **(170-171)**
Cushman Electronics **(143)**
Decibel Products, Inc. **(116)**
ESB, Inc. (Exide) **(128-129)**
ESE Limited **(150)**
Erico Products, Inc. **(177)**
Farinon Electric **(197)**
General Cable Corp. **(125)**
General Electric Co. **(118-119, 165)**
General Railway Signal Co. **(107-108)**
Grasis Fabricating Co. **(198)**
Granger Associates **(181)**
Harmon Electronics, Inc. **(105-106)**
Henkels & McCoy **(149)**
The Kerite Company **(140)**
LaMarche Mfg. Co. **(303)**
Lenkurt Electric Co., Inc. **(155-157)**
3M Company **(207)**
M&M Contracting Co. **(153)**
Motorola Communications & Electronics, Inc. **(122-124)**
Nife, Inc. **(134)**
Pulsecom **(103-104)**
RFL Industries **(112)**
Radio Corp. of America **(173)**
Railroad Accessories Corp. **(120-121)**
Rohn Communication Facilities Co. **(102)**
SACE, Inc. **(137)**
Sangamo Electric Co. **(145)**
Servo Corp. of America **(194-196)**
Stewart Warner Electronics **(132-133)**
Stromberg-Carlson **(160-162, 167-169)**
Superior Continental Corp. **(193)**
Sylvania Electric Products, Inc. **(158-159)**
Teletype Corp. **(135-136)**
Wescom, Inc. **(208)**
Western-Cullen Division, Federal Sign & Signal Corp. **(109-111)**
Westinghouse Air Brake Co. **(100-101)**
Wheel Checkers **(210)**

Data Systems meets in Atlanta

Three-day meeting at Regency-Hyatt House features talks, workshops, panel discussions and exhibits of nine firms.

Monday Sept. 28

9:00 a.m.—**Opening remarks** by G. M Leilich, Chairman, Data Systems Division, and Vice-President Operations, Western Maryland.

Keynote Address: "A Look Back, A Look Ahead," by W. Graham Claytor Jr., President, Southern Railway.

Major Address: (To be announced).

Noon—**Luncheon and Address:** Prime F. Osborn, III, President, Seaboard Coast Line.

1:30 p.m.—Concurrent Workshops

No. 1: Materials Data Systems

W. J. Eck, Vice-President Purchases & Materials, Chesapeake & Ohio/Baltimore & Ohio

T. R. Grady, Manager of Materials, Chesapeake & Ohio/Baltimore & Ohio

R. E. Rathert, Manager of Materials, Missouri Pacific

No. 2 Mechanical Data Systems

J. W. Hawthorne, Assistant Vice-President Equipment, Seaboard Coast Line

J. G. German, Assistant Vice-President Engineering, Missouri Pacific

J. A. New, Senior Assistant Engineer, Seaboard Coast Line

No. 3 Terminal Data Systems

P. E. Odom, Vice-President Management Services, St. Louis-San Francisco

No. 4 Engineering Applications

W. W. Simpson, Assistant Vice-President, Engineering & Research, Southern

No. 5 Marketing Applications

P. H. Banner, Assistant Vice-President, Market Research, Southern

P. F. Cruikshank, Assistant Vice-President, Market Planning, Burlington Northern

H. T. Landow, Assistant Vice-President, Planning, Communications & Computer Services, Illinois Central

O. J. Hermann, Jr., Coordinator Traffic Data Services, Southern Pacific

No. 6 Computer Planning in Mergers

J. M. Ostrow, Assistant Vice-President, Systems Development, Penn Central

F. H. Coyne, Vice-President Management Services, Burlington Northern

L. H. Scott, Assistant Vice-President, Systems & Information Services, Seaboard Coast Line

No. 7 Centralized Billing and Collections

R. J. Dullard, Assistant Comptroller, Chesapeake & Ohio/Baltimore & Ohio

No. 8 Data Exchange

R. P. de Camera, Vice-President, Administration, Illinois Central

R. O. Hughes, Director, Management Services, Detroit, Toledo & Ironton

J. L. Jorgensen, Director, Management Information Services, Union Pacific

S. A. Alward, Director, Management Information Services, Louisville & Nashville

G. Pipas, Vice-President, Communications & Computer Services, Illinois Central

No. 9 ACI in a System

R. H. Tivy, Assistant Chief of Transportation-Planning, Canadian National

R. Cass, Senior Research Engineer, Canadian National

J. H. Seamon, Senior Industrial Engineer, Missouri Pacific

J. W. Barriger, Jr., Manager, Market Development, Sylvania Information Systems

No. 10 Impact of TRAIN on Car Distribution

W. H. Van Slyke, Chairman, Car Service Division, AAR

J. J. Willis, General Superintendent of Transportation, Southern Pacific

D. A. Baumgartner, General Superintendent of Transportation, Santa Fe

W. B. Vander Veer, General Superintendent Transportation, Chesapeake & Ohio/Baltimore & Ohio

Tuesday Sept. 29

8:30 a.m.—**Panel Discussion—Lesson of the 60's**

Moderator: F. H. Coyne, Vice-President, Management Services, Burlington Northern

"Lessons Learned About Computers, Hardware and Software, and Their Use in the Railroad Industry," by S. A. Alward, Director, Management Information Services, Louisville & Nashville

"Developments and Applications in the Fields of Operations Research and Industrial Engineering," by P. B. Wilson, Chief of Cybernetic Research and Industrial Engineering, Canadian National

"Application of Data Systems Techniques from the Railroad Point of View," by G. S. Sines, Director, Information & Control Systems, Missouri Pacific

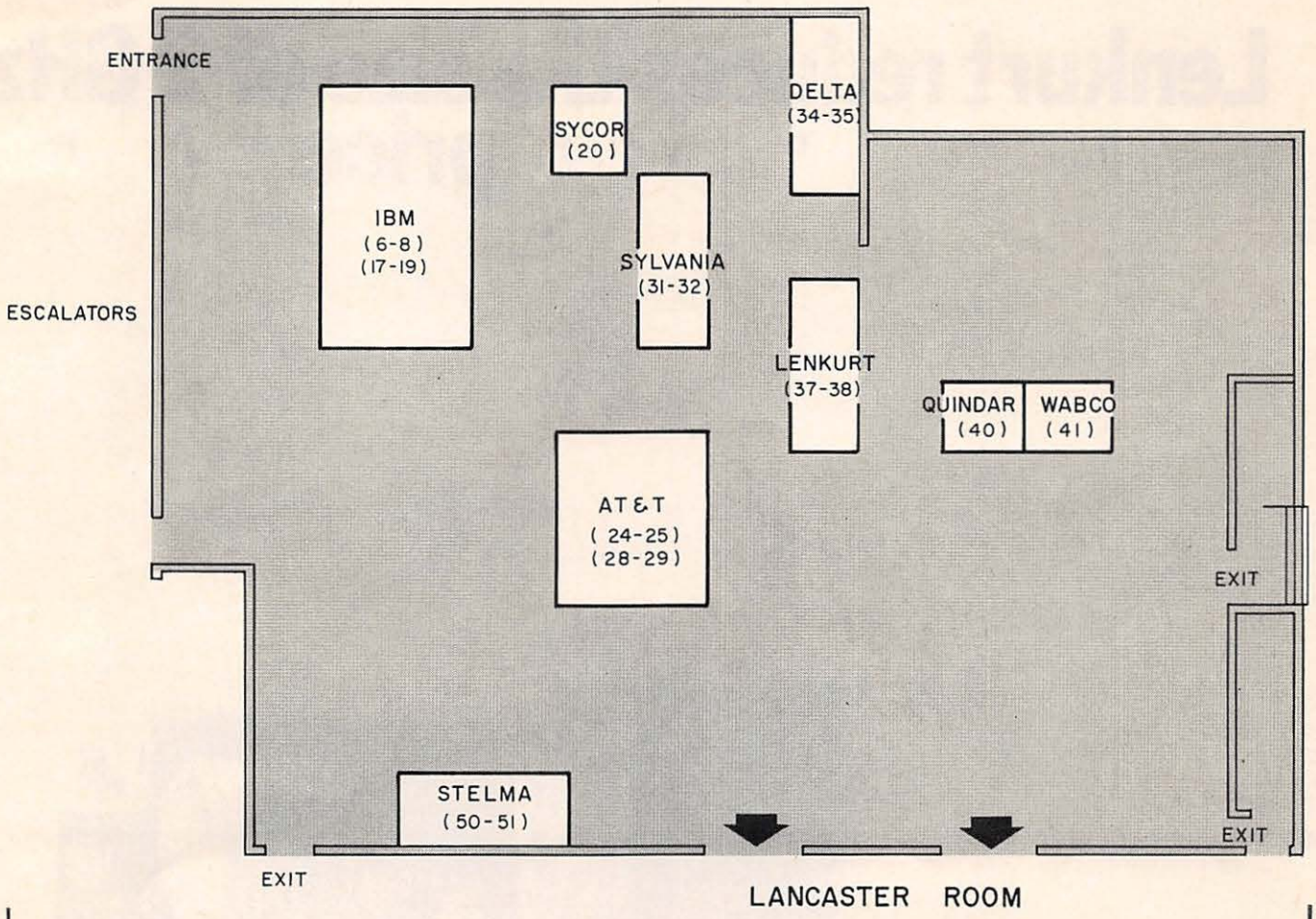
Panel Discussion: "A Look Ahead to the Systems of the 70's

Moderator: R. C. McGowan, Vice-President Planning, Chesapeake & Ohio/Baltimore & Ohio

"Planning Large Communications/Computer Networks," by R. R. Crane, Group Vice-President, Science Management Group, WOFAC

"A Centralized Computer/Communications System," by J. W. Germany, General Manager—System Manage-

REGENCY HYATT HOUSE - ATLANTA



Nine exhibitors have a wide range of products including computers, communications equipment, and automatic car identification. Also of interest to DSD members attending the annual meeting are consulting, software and programming services available from manufacturers.

American Telephone & Telegraph Co. **(24-25, 28-29)**
Data Products Stelma Telecommunications **(50-51)**
Delta Data Systems **(34-35)**
IBM Corporation **(6-8, 17-19)**
Lenkurt Electric Co., Inc. **(37-38)**
Quindar Electronics, Inc. **(40)**
Sycor, Inc. **(20)**
Sylvania Electric Products, Inc. **(31-32)**
Westinghouse Air Brake Co. **(41)**

ment Services, Southern Pacific

"Distributed Computer/Communications Capability," by H. N. Laden, Assistant Vice-President Research, Chesapeake & Ohio/Baltimore & Ohio

12:30 p.m.—**Luncheon and Address:** Thomas M. Goodfellow, President, Association of American Railroads

2:00 p.m.—**Group Tours**
1—Southern Railway System
2—Carlings Brewing Company

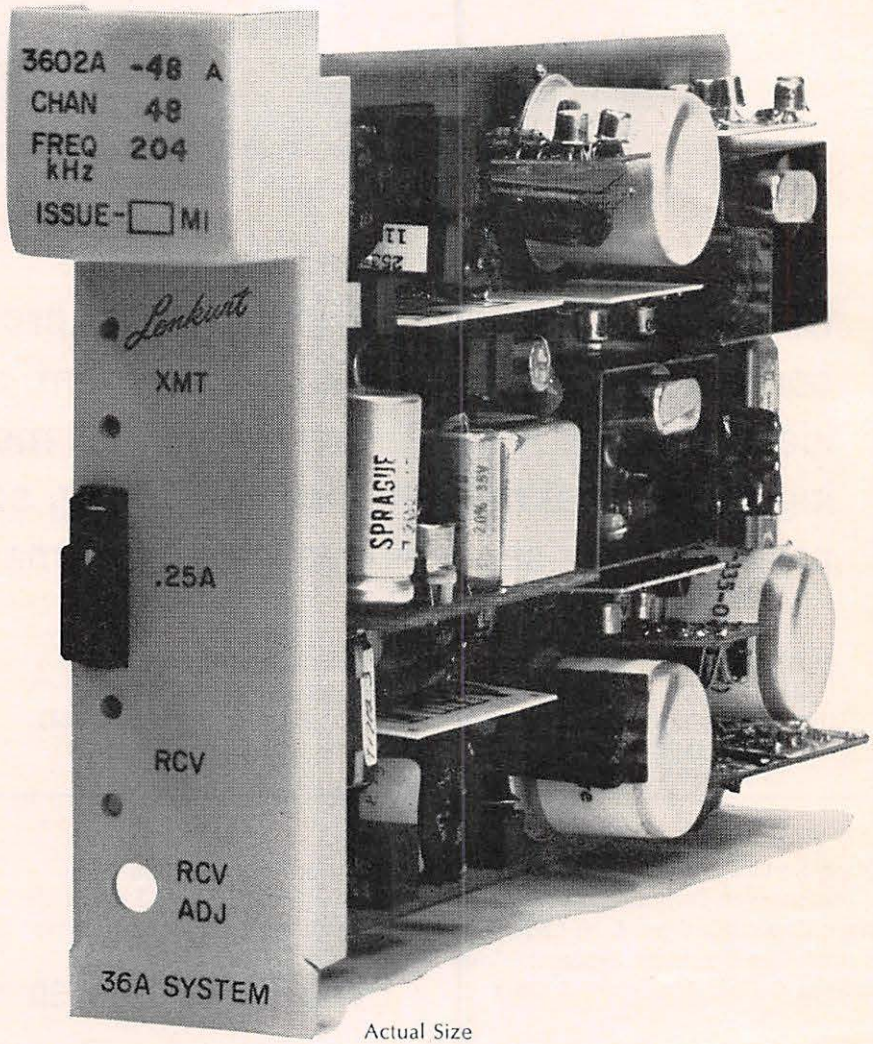
Wednesday Sept. 30

9:00 a.m.—**Address:** Commander Grace Hopper, Director of Navy Programming Languages Division, Office of Information Systems Planning & Development, Department of the Navy

Progress Report "Latest Developments Concerning ACI, UMLER, TRAIN and Other Items of Immediate Division Interest," by R. A. Petrash, Executive Director, Data Systems Division, AAR

12:30 p.m.—Get-Away Luncheon

Lenkurt reduces the size of 2 GHz
" " " price " " "



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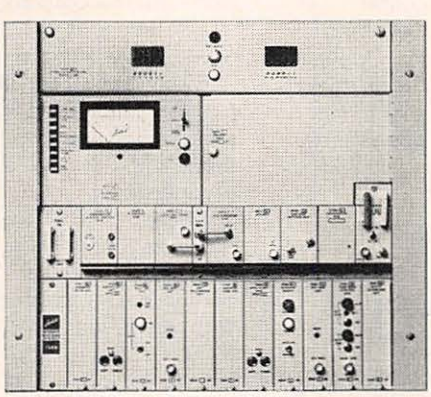
Or write: Lenkurt Electric Co., Inc., Dept. C720, 1105 County Road, San Carlos, California 94070, for complete literature.

Lenkurt 36A 48-channel Radio Multiplex single channel stackable — 12 channels (three mounting spaces high) on a 19" rack — channels are identical except for small plug-in channel selection oscillators, so one channel (less oscillator) is all the "spare parts" you need — operates directly from 24 or 48 volts with 17-18 dBrncO noise — built-in E&M signaling.

Lenkurt 78F2 600-channel 2 GHz Microwave Radio 5 watt power output — operates directly from 24 or 48 volts — 8 dB receiver noise figure — 18 dBrncO/hop noise performance — a duplex system with baseband and power distribution equipment takes up only 10 mounting spaces on a 19" rack — push-button monitoring of power output, deviation, transmitter frequency and receive signal level — built-in alarms monitor power output, off frequency, receive signal level, transmit pilot and operation of hot standby switch.



78F2 Microwave System

LENKURT ELECTRIC
GENERAL TELEPHONE & ELECTRONICS

Circle 3 on reader service card

PRODUCT SHOWCASE

Video I/O terminal works with computer (101)

The new video terminal receives input data from a computer, permits introduction and editing of data from the keyboard and provides necessary storage of this character display data on the CRT screen, and for data transmission.

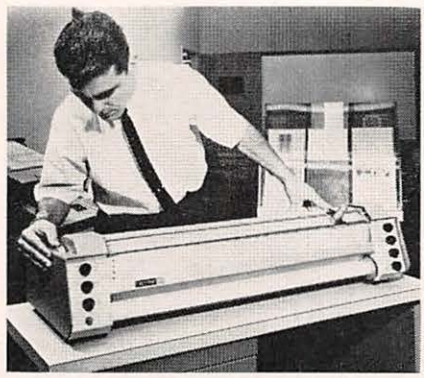
Half and full-duplex data provisions are available. Operating in asynchronous or synchronous serial mode, input and output rates can range from 75 to 9600 bps. In parallel mode, rates range up to 15,000 characters per second. The ADS-760 can operate as a single Teletype replacement or as a high speed information retrieval device or anywhere in between.

Two video outputs are provided on identical but separate remote monitor circuits. An optional split screen permits such inquiry/response and/or form filling operations. Display formats range from 4 lines of 32 double size characters (128 total characters) to 30 lines of 80 single size characters (2400 total characters). The standard character repertoire contains upper case "A" through "Z", "0" through "9" and punctuation marks. Optional character sets include both an upper and lower case alphabet, superscript/subscript capabilities and special symbols for graphic generation capability. *American Data Systems.*

On-line terminal provides I/O to a computer (102)

The TC 500 on-line terminal is a unit that can provide data input and output to a central computer system. It can also provide editing, formatting and shared processing. The TC 500 is a solid state computer with its own compact memory, powerful logic and full arithmetic capability. The internally stored program provides complete local control of processing, print formatting, printer positioning, and forms movement. Its buffering assures maximum operating simplicity and productivity, and line speed transmission of larger, more complete messages.

The TC 500 permits complete data input through its electronic alphanumeric typewriter and numeric ten-key keyboard. Also, this terminal can handle input/output via punched cards or punched paper tape. Also, the TC 500 can transmit up to 1800 bits per second. *Burroughs Corp.*



Digital plotting system works from computer (103)

A series of digital plotting systems provide a means of producing ink on paper or microfilm plots of computer output data. There is no restriction on format, so that a pictorial representation may include any desired combination of axes, lines, letters and symbols, with unlimited choice of scale factors, letter and symbol sizes and printing angles. Three model series of electromechanical ink on paper digital plotters use either 8-vector structure or 24-vector structure commands.

Either drum or flatbed type plotters are available. Drum type plotters are available in two sizes: a 12-inch drum and a 30-inch drum. The plot is produced by rotary motion of the drum and lateral motion of the pen carriage. Either ballpoint or liquid ink pens may be used. The drum type plotter uses special chart paper rolls and can produce continuous plots up to 120 ft in length. Flatbed plotters are available in 31 x 34" and 54 x 72" plot area. *California Computer Products Inc.*

Magnetic tape unit handles data at 2400 wpm (104)

The 4210 magnetic tape terminal functions just like a paper tape punch and reader except the 4210 uses magnetic paper cartridges. It can handle data distribution and collection at speeds up to 2400 words per minute. It automatically switches to the receive mode on completion of transmission. For error correction, a single spacing control permits moving the tape in forward or reverse direction one character at a time. The correct character is then recorded over the erroneous one. To locate data the tape can be searched at the rate of 400 characters per second, either forward or reverse. *Teletype Corp.*

I/O unit interfaces with computer or is free (105)

The 820/03 terminal can interface with any other computer or terminal device or act as a free-standing system with full computer capabilities. It is complemented by a full range of peripherals—card, paper tape and magnetic tape input/output devices.

The 820/03 provides audited, edited and formatted data. Both vertical and longitudinal parity checking are used. Errors are detected and corrected at the source before transmission. It generates any five to nine level code configurations. Transmission speeds are 50 to 2400 baud, synchronous or asynchronous.

By interconnecting a number of 820/03 terminals with one 820/51 communications control unit and up to two 820/56 magnetic tape units, a data collection system is created. Interconnections between the 820/03 terminals and the control unit is via direct cable or telegraph/telephone lines. Up to 16 terminals can be direct cable-connected with a maximum cable length of 600 ft. Eight terminals may be connected simultaneously in a telecommunication environment. *Business Machines Group, Victor Comptometer Corp.*

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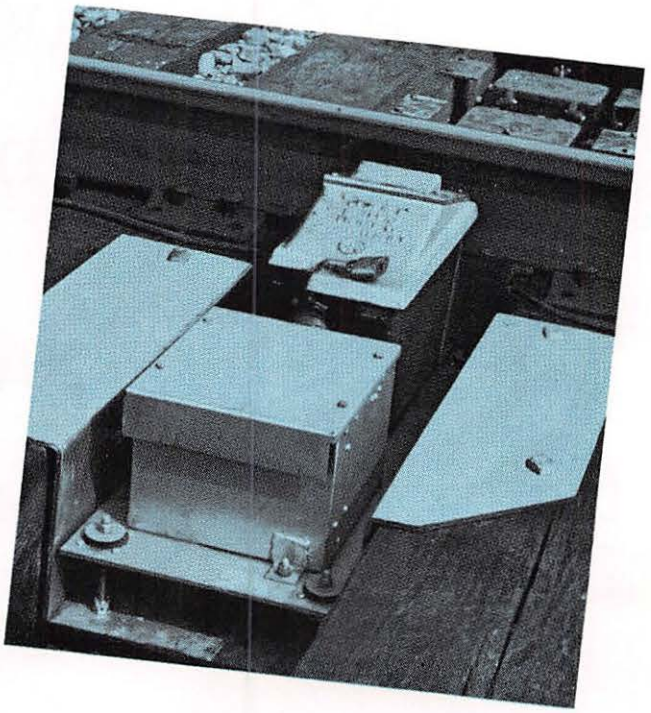

FSO

Frequency Shift Overlay track circuits for highway crossing protection – fail safe, high immunity to noise and interference. Fifteen frequencies, all compatible; five mounting options. FSO superimposes directly on a-c, d-c, or coded track circuits – no costly insulated joint installation.

WTSU

Wheel Thermo-Scanner Unit for hot box detection focuses on the wheel hub – where it counts. Automatically calibrates its accuracy every 60 seconds. Immune to hot sun, it stays in adjustment. Effectively detects at speeds of 5 to as high as 120 mph. Bidirectional operation makes it ideal for single track.

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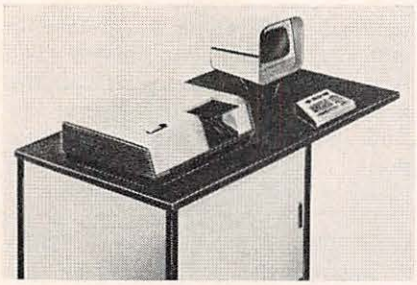
PRODUCT SHOWCASE



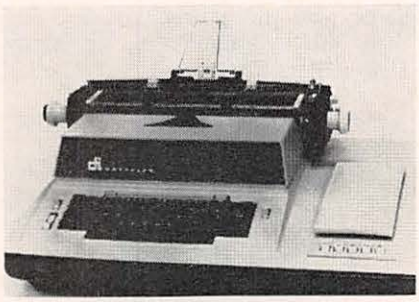
OCR device processes up to 1800 units/hr (106)

A complete, compact optical character recognition system unit ROCR System/70 can process up to 1800 documents per hour in-house or from remote scanners. The ROCR System/70 consists of the standard Cognitronics remote desktop scanner with automatic feed, a display console and keyboard, and a central processing unit.

The Unit ROCR System/70 is so easy to use that any qualified keypunch operator can learn to operate it in a single day. The system features on-site or remote scanning—the Unit system can switch its input from the local or remote scanner, as desired. Multiple standard numeric fonts may be used and may be intermixed as well on the same document. Likewise, machine generated and handprinted numeric characters may be intermixed. Any character unrecognized by the system are displayed on the console and are quickly identified and inserted by the operator by simply depressing the appropriate character on the keyboard. *Cognitronics Corp.*

Computer controls input from keystations (107)

A computer-controlled keyboard input system called CMC Key Processing, allows source data to be entered via up to 32 individual keystations. The data is processed by the system's mini-computer and then transferred to a magnetic storage disk, where the batches of work are written, verified and corrected. On command, the batches are transferred, in sequence, to one single reel of magnetic tape which becomes clean input to the main computer system. *Computer Machinery Corp.*



Transmitting typewriter works on phone lines (108)

Using the new Dataplex T30 recording transmitting typewriter, it is now possible to prepare business data at remote locations and conveniently and economically send it over voice-grade telephone lines for computer processing. The T30 operates as an ordinary office electric typewriter but has the capability to record all typed information on an internal magnetic-tape cassette recorder for later transmission via telephone lines.

The T30 operates in several modes, controllable by a return signal from the receiving station, which allows it to send data continuously and hang-up after all data has been correctly received. If transmission errors occur, the T30 will partially rewind its cassette and retransmit the same data—eventually clearing the error, passing over it if it is persistent, or terminating transmission if line quality causes errors that are numerous and persistent. Input power is 115 volts AC, 60 Hz, 85 watts. *Data Instruments Co.*

Send-receive data terminal meets EIA interface (109)

The PDM 6633 ASR is an automatic-send-receive data terminal with a photo-electric paper tape reader and solenoid array perforator. The unit has an impact printer with 132 print positions and prints 64 ASC11 characters. The PDM 6633 uses either carbon or cloth ribbon cassettes and provides clean high fidelity copy.

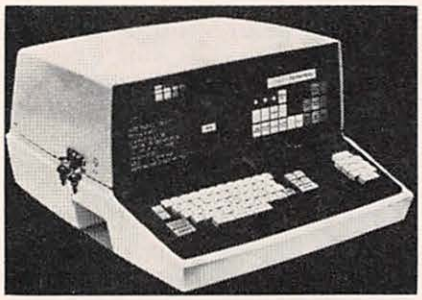
The PDM 6633 operates 10, 15, or 30 characters/second and has a wide, 132-character carriage for maximum throughput. The terminal is fully compatible with EIA Standard RS-232B interface. Transmission code is USAC11 and the terminal will operate in a full or half-duplex mode. The ASR version has a 30 character/second paper tape reader and punch; other options include a 10-key numeric nest similar to an adding machine format, internal modem and various message controls and indicators. The PDM 6633 is also available as an RO (receive only unit) and a KSR (keyboard send-receive unit). *Peripheral Data Machines, Inc.*

Portable data terminal works with computer (110)

A portable computer-communications terminal travels in a briefcase for traffic managers, freight salesmen and transportation engineers who need instant access to the company's computer located some distance away. The new interactive terminal, called PortaCom, can be hand carried in an attache case anywhere. It weighs less than 30 lb with all options.

PortaCom produces full-page computer printout with up to three carbon copies. For instant computer access, the PortaCom has its own built-in acoustic coupler. It needs only a standard power outlet and a telephone to begin operating. PortaCom has a standard ASCII keyboard and is Teletype compatible. *Data Products Corp.*

PRODUCT SHOWCASE



Remote data terminal has CRT display (111)

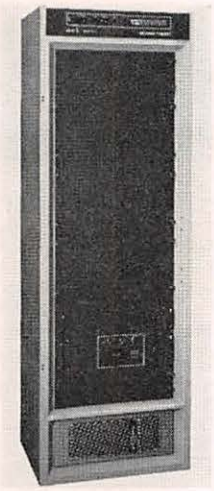
A new remote data terminal has large CRT character size, total capacity of 1,024 displayable characters, and a special feature which permits the operator to concentrate on any 32-character by 8-line segment of the total display by "rolling" the display up and down like paper in a typewriter. Another important feature is direct "natural conversation" communications between the operator and the computer.

A number of peripheral devices have been designed to operate with the Computerminal, including the alphanumeric keyboard, alphanumeric line printer, remote CRT monitor, several discrete displays and a telephone data-set interface. *Wyle Laboratories.*

Two-way radio has twelve channel capability (112)

A new all solid-state, 30 watt FM-2 way radio with 12 channel capability for mobile, portable and base operations in the 132-174 MHz frequency range is called "Porta Command." Model PC-230 measures only (HWD) 3½" x 10½" x 6¾". The unit operates from an external 13.8 volt nominal power source. It is also easily convertible to 117/220 volt AC operation.

The PC-230 operates in a range of −30°C to 60°C with ±.0005% frequency stability in narrow band and ±.0015% in wide band. Sensitivity is less than 0.5 microvolt for 20 db quieting with residual hum and noise down more than 50 db with standard modulated input. The PC-230 will operate efficiently on up to 12 channels within a 600 kHz range without any performance degradation. High performance on 12 channels throughout a 1 MHz range can be accomodated with no power loss and less than 3db degradation in sensitivity. *Hallicrafters Co.*



ACI system reads AAR approved labels (113)

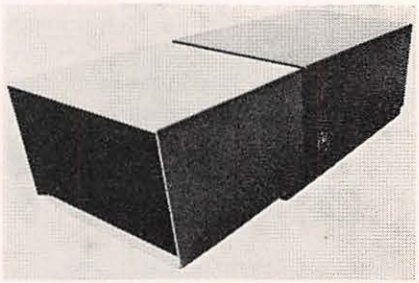
The VC-1 automatic car identification system provides a means of automatically identifying railroad vehicles, trailers and containers carrying the AAR-approved color-coded ACI label. The ACI system scans the label, decodes and transmits the label identification information. It can transmit the information directly as it is being read, or it can be stored internally, outputted on demand or polled by a control center, such as a computer.

The transmitted output can be fed directly into a computer for storage; used to operate peripheral devices, such as teleprinters or card punch machines; used in process control, such as in automatic classification yards; or transmitted in communications systems such as teleprinter, telephone or microwave. *Signal & Communications Division, WABCO.*

Binary synchronous unit works with mag tape (114)

The new 7201 Binary Synchronous Communications Adaptor sends from or receives on magnetic tape. The basic 7201 system consists of the 7201 adaptor and a Mohawk data-recorder with a special interface feature. An optional 7520 printer can, under operator or remote control, monitor data being written on tape, print data that is not being written on tape, or idle. And, of course, the data-recorder and printer can function offline for enter, verify, search and print operations.

The 7201 can operate on a net with 360's, 2780's and other 7201's. A data-recorder can be used for data entry one minute and used to transmit the data to a central computer the next. *Mohawk Data Sciences Corp.*



TV camera uses light amplification (115)

Without a single adjustment, the new closed circuit television camera provides a minimum of 500 lines horizontal resolution between 0.05 foot candles scene illumination (similar to moonlight conditions) and 8,000 foot candles (the equivalent of bright sunlight). The camera has a specially designed 10:1 zoom lens, and one-year warranty on all parts and labor.

The exceptional flexibility of the new camera is due to the method Motorola developed to bond the image intensifier to the fibre optics faceplate of the vidicon tube, and to the attenuation technique which significantly improves camera reliability by providing optimum protection of the vidicon in exceptionally high illumination situations. *Motorola Communications & Electronics Inc.*

Self-teaching techniques featured in courses (116)

Tailor-made courses for railway signaling and communications departments to meet specific training objectives feature self-teaching lessons. Exclusive Auto-Programmed lessons simplify employee studies, speed the learning process, and insure maximum comprehension. Special discounts are available to companies under Participating Education Plan. *Cleveland Institute of Electronics.*

Let V/I* be your umbrella.

You know what can happen when moisture gets into railroad communications cable. Circuits fail. Schedules go out the window. Shipments are lost. You know the rest.

General Cable's new V/I (Vapor Impervious) communications cable construction is designed to avoid all that.

A thin metallic barrier acts as the moisture shield without significantly adding to the weight or diameter of the cable. The barrier is supported and protected by layers of special polyethylenes on both sides. The entire V/I component is formed about the cable core with the edge heat-and-pressure sealed along its entire length. It is available on both Qualpeth and Stalpeth types.

If you'd like to find out more about General Cable's V/I cable, contact us. It just might help you keep things running smoothly. Write to: General Cable Corporation, Section 600-25, 730 Third Avenue, New York, N.Y. 10017.

General Cable

*V/I is General Cable Corporation's trademark for its Vapor Impervious communications cable. U.S. Patent 3,206,541.

PRODUCT SHOWCASE

Coaxial system handles up to 1260 channels (117)

Coaxial transmission systems providing 120, 300, or 1260 voice channels feature four-kHz voice channels or combinations of voice channels and broadband data within the carrier spectrum.

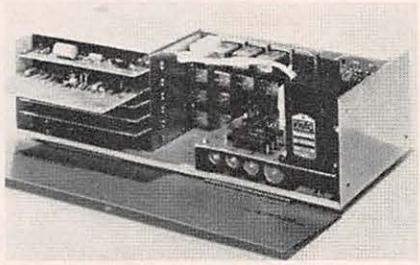
CCS 120 coaxial cable transmission provides 120 voice channels in the spectrum from 60 kHz to 552 kHz. Repeater spacing is 7.4 miles on either buried or aerial cable. Repeater gain is 46.6 db at 552 kHz. The CCS 300 transmission system provides 300 two-way telephone channels or equivalent for 4 kHz bandwidth in carrier spectrum from 60 kHz to 1300 kHz, divided into five 240 kHz supergroups, each supergroup carrying 60 channels. Repeater spacing is 3.7 miles. Repeater gain is 36.0 db at 1300 kHz. The CCS 1260 system provides 1260 4kHz telephone channels or equivalent bandwidth, between 60 kHz and 5564 kHz divided into 21 60 channel supergroups. Repeater spacing is 1.85 miles with a repeater gain of 37.6 db at 5636 kHz.

Transmission system cable consists of two, or multiples of two, coaxial pairs and a variable number of single or paired conductors which are surrounded by various jackets and sheathing which permits the cable to be directly buried or can be spun onto a pre-installed messenger along an existing pole line. *Cable Communications Systems Inc.*

System has voltage and frequency control (118)

The P-1000 automatic power system provides voltage regulated and frequency controlled power for computer and other complex electronic systems needing continuous regulated power. Output voltage to the computer is constantly monitored by a graphic voltage recorder and is set to meet computer manufacturers' recommendations. Maximum output frequency variation is ±0.5% with a ±.5% variation in power supply. (This can be reduced to ±0.05%). Maximum output variation is ±2% which could be reduced to ±1%.

Instrumentation indicating input and output supply is standard equipment including the graphic voltage recorder. Sizes available are incremental to 3,000 KVA and the P-1000 system can be provided in multiples up to 5,000 KVA. The P-1000 APS system functions while normal power sources are operating or when interrupted. It is completely automatic and requires no personnel to operate the system. The P-1000 APS removes spikes, dips and most harmonics from incoming power and reconstructs the wave form into clean power. Key units in the system include motor generator sets, batteries, voltage regulator, automatic start and transfer equipment, among others. *Continuous Computer Power Inc.*



Automatic number dialer handles six numbers (119)

The Telemat automatic number dialer is intended for applications where certain telephone, Telex or TWX numbers are frequently called. The unit dials up to six 11 digit numbers, initiated either by an associated push button pad or relay contact closure. All six numbers can be dialed simultaneously or in sequence. The unit is completely self contained and utilizes integrated circuit logic for maximum reliability. In case of a Busy signal, the unit resets instantaneously. The unit can be arranged for tone-dialing, optional.

This unit responds to computer commands to dial, and gives acknowledgment signal when remote station is on-line. *Kameco Electronics Ltd.*

Long-life battery uses KOH electrolyte (120)

An industrial nickel-cadmium battery designed to last almost a third of a century has potassium hydroxide as the electrolyte which has no corrosive effect on metal parts and instead acts as a preservative. The liquid level of the electrolyte can be visually checked because the container is translucent polystyrene.

Evaporation and carbonation of the electrolyte are controlled by a layer of pure mineral oil resting on top of the solution to reduce maintenance requirements. This nickel-cadmium battery can go as long as two years or more without adding water. It is not damaged by freezing and will perform at extremely low ambient temperatures when necessary.

In operation, the battery can produce high discharge surges even when in a partial state of charge. On open circuit, there is almost complete chemical inertness within the cell, minimum loss of charge and no gassing. The battery is designed to regularly provide high discharge rates and to accept high recharge rates. *Exide Power Systems Division, ESB Inc.*

Distribution cables handle 600v to 35kv (121)

A four-page bulletin describes cables for power distribution service from source to load—into plant, intraplant, and interplant. Typical installations are illustrated. Specification detail shown with typical designs from 600 volts to 35kv. Terminations for indoors and outdoors are also shown. *The Kerite Company.*

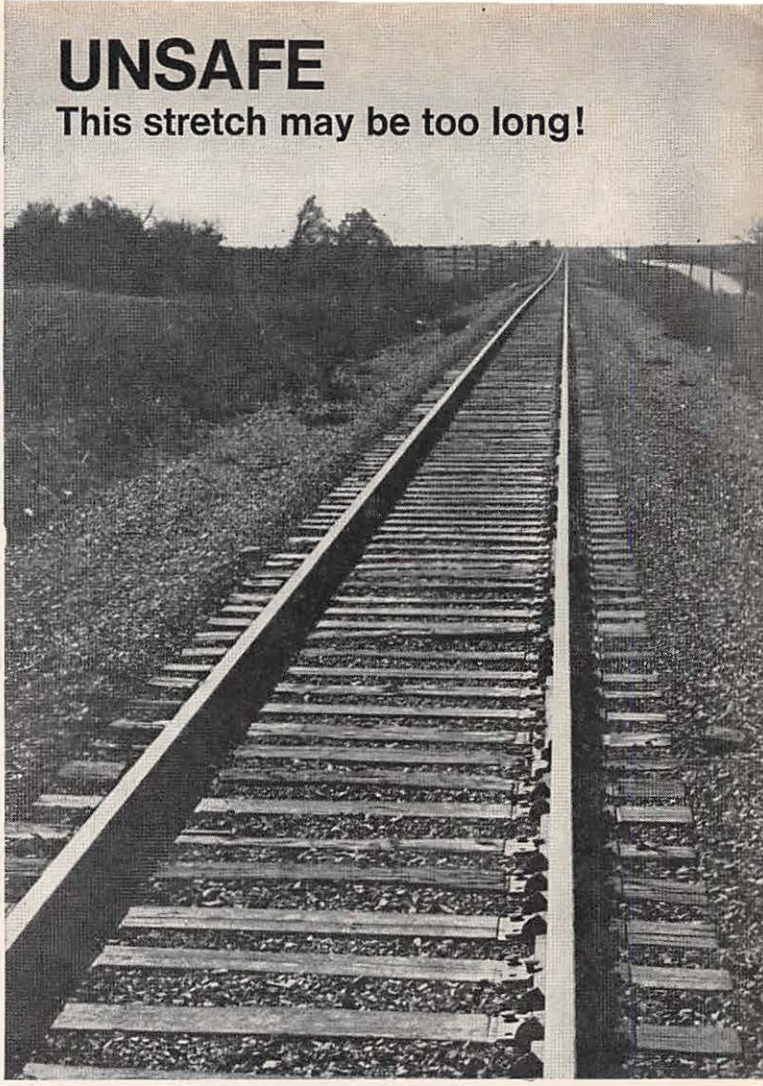
Dispatcher signaling uses tone selection (122)

An innovation in dispatcher signaling, permits the use of all types of voice transmission circuits, while retaining the traditional selector keys and selectors.

Electro-mechanical selective ringing, with its pulses of high voltage direct current, has been limited generally to either dispatcher's or message circuits over open wire or railroad owned cable. Tone-pulse selective calling takes advantage of installed dispatching telephone equipment in the form of type No. 62-A or No. 63-A selector keys and type No. 60-AP or No. 60-BP selectors.

By converting the output of selector keys to shifting audio tones and reconverting the tones to reversing pulses of direct current at each waystation.

A new tone pulse receiver TPR-2 operates from 12 volts DC. Output to the selector is 12 volts which requires modification of the No. 60 type selectors. The manufacturer suggests return of the selectors for conversion. This involves change-out of selector coils to 12-volt windings, strapping the capacitor and arrangment of wiring to provide an answer-back tone in the usual manner, bypassing the receiver. *Plat-General.*



Our new rail-mounted SERVOSAFE® Hot Box Detective™ prevents axle burn-offs and derailments.

It's a good thing to have on your railroad.

But, for safety's sake, don't stretch a good thing!

Do you have long stretches of track without SERVOSAFE protection?

Recent studies have revealed that such factors as heavier car loadings, faster train speeds and greater accelerations have combined to increase the incidence of overheated journal boxes. This has prompted many railroads to review their spacing of hot box detectors. Up to now, the average spacing has been 25 to 30 miles apart along line-of-road. Under today's conditions, however, a hot box can develop in less than 25 miles and cause a derailment *between* detectors.

One solution becomes self-evident: closer spacing of hot box detectors for more protection. A SERVOSAFE system will not prevent a hot box—but it will detect, locate and warn of a hot box before the condition worsens into a dangerous, costly axle burn-off and derailment!

Will it cost you more to get this additional SERVOSAFE protection? Not really. Here are some reasons why not:

Our new Model 8808 SERVOSAFE system features patented rail-mounted scanners and solid state electronic data processing for the fastest, most precise detection of hot boxes. It allows remedial action to be taken *before* a failure occurs, and helps cut down the high costs of major salvage or replacement. The cost of installation and maintenance is appreciably reduced by eliminating the need for concrete foundations, special ties and expensive roadbed preparation. The rail-mounted scanner can be easily removed for maintenance or relocation. Finally, compare the cost of a SERVOSAFE with the $200,000 involved in just one derailment that could be prevented.

That's why most prudent, progressive railroad managements agree when we say, "More SERVOSAFE protection isn't costly—*lack of it is!*"

Model 8808 SERVOSAFE Hot Box Detective Rail-mounted scanner "looks" at journal bearing behind truck frame with a vertical, close-in target scan for greater uniformity and accuracy. Scanner is securely clamped to the rail (no drilling required). Accuracy is not affected by rail pumping, running or lateral movement.

servo

SERVO CORPORATION OF AMERICA
Hicksville, N.Y. 11802 • Tel. 516-938-9700
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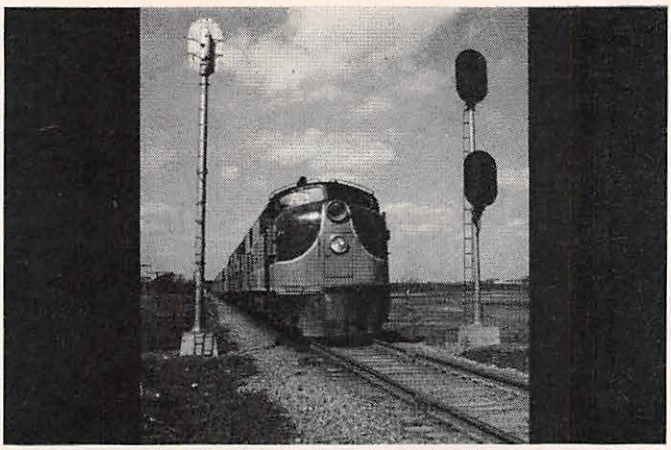
Serving Safety Through Science

Since 1957, more than 1,000 SERVOSAFE Hot Box Detective systems have been put into service on 54 of the world's major railroads, and have compiled an unequaled record of safety improvement and cost reduction.

MEMBER RPI



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PRODUCT SHOWCASE

Snow melter has oil burner unit (123)

A new snow melter solves the snow problem before it turns to ice by producing a contained atmosphere of hot air (the entire distance between the switch point and stock rail) to vaporize the snow before it makes contact, and does the job completely without open flame.

The Raco snow melter is similar in operation to a conventional oil burner. While the flame is safely contained in a combustion chamber, the hot air (approx. 400°F) is discharged through two nozzles located inside of both stock rails approximately 20″ in front of the point. Velocity of the air is 45 mph at a volume of approximately 5500 cu ft/min. (Figures will vary with ambient temperature, air density, wind and fuel quality).

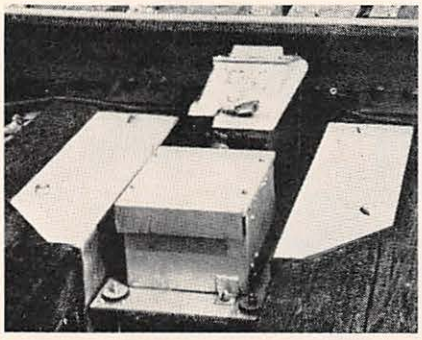
For yard and interlocking locations the unit is manually activated from a control point wherever the switch is visible. For remote switch locations in block signaling or CTC territories, the Raco snow detector is used to start the snow melter in operation. *Railroad Accessories Corp.*

Microwave system has high channel capacity (124)

The new microwave systems, designated the type 75B2 for the band 6.425 to 7.125 GHz and type 75E1 for the band 12.2 to 13.25 GHz, will transmit up to 1200 voice-frequency channels or a video signal on long-haul, backbone routes of 2,000 miles or more. Quality performance is assured because of their high power output coupled with their arrange-

ment as low-noise heterodyne repeaters. Systems are fully solid-state with a traveling wave tube serving as the transmitter power amplifier.

In addition to optional path protection arrangements, two service channels, a video clamper and monitor, and a choice of three program channels are also available. *Lenkurt Electric Co., Inc.*



Hotbox detector views wheel hub (125)

The improved Wheel Thermo Scanner Unit has a single scanner on each side of the track which scans wheels passing in either direction at speeds from 5 to 85 mph. This wide range can be extended to 120 mph by reducing the output pulse width. A protective door on the radiometer closes when trains are not being scanned. An internal shutter ensures that the cell views only its intended target. An internal blower helps prevent the entry of dirt when the protective door is open.

As each train wheel passes the selected scanner wheel detector, the radiometer cell's internal shutter opens for 4 milliseconds, taking a "heat snapshot" of the passing wheel. Heat, radiated from the wheel hub, is focused on the lead selenide detector, where it instantly produces a voltage pulse proportional to the highest temperature scanned on the passing wheel. This voltage pulse is amplified and added to a wheel marker pulse which was produced when the wheel was detected. The sum of these two pulses is fed to a recorder (either directly or by carrier) where it appears as a deflection on a chart. An amplified deflection therefore is an indication of a hot wheel hub.

After the last car of the train passes, the blower stops, the protective door closes, and the cell takes one reading from the internal reference target (on the back of the protective door) which is heated to the temperature of a hotbox. The pulse from this reading is registered on the recorder chart, and then the recorder stops. The operator is thus assured that the system was operating properly and capable of detecting a hotbox. *General Railway Signal Co.*

Patch cords have single or double conductor (126)

Single and double conductor braided patch cords, in lengths from 1-6 ft are now available in standard colors. When ordering braided cords, however, the suffix "B" should be used, following the catalog ordering number and length of cord desired. *Western-Cullen div. Federal Sign & Signal Corp.*

Line voltage variations detected by unit (127)

PowerGuard is designed to detect and give warning to the computer user of line voltage variations caused by any type of power system disturbance. The unique automatic trigger design of PowerGuard allows months of information to be recorded on a single strip chart. The recording interval begins when a transient occurs and ends with the reset signal which can be either manually or automatically generated. The activation of the "Auto Reset" button places PowerGuard in a fully automatic mode; any transient starts the recorder, displaying the amplitude and duration of the activating transient. If no additional transients occur within 60 seconds, the recorder stops and PowerGuard returns to its "monitoring only" mode. *Western Union Computer Utilities Inc.*

TAKE ADVANTAGE OF UNIT EXCHANGE ON TYPE #60 SELECTORS

No need to let bad-order components accumulate in the shop or storeroom. Have them exchanged for thoroughly reconditioned spares. Then put them to work.

Save time and money.

Send us your sick selectors. For a nominal charge we'll return a like quantity of rebuilt and tested units. We'll even substitute #60-BP's for #60-AP's, if you desire.

Here's an economical way to obtain those extra selectors for remote control of base radio, for remote patching, or for other new applications.

We're in the best position to do this work efficiently. As successors to Western Electric Co. in the manufacture and sale of train dispatching telephone equipment, we continue to supply the industry with new units. From our stocks of factory parts, we also furnish replacement parts for maintenance.

We invite you to try unit exchange.

General Communications Prod. Div.

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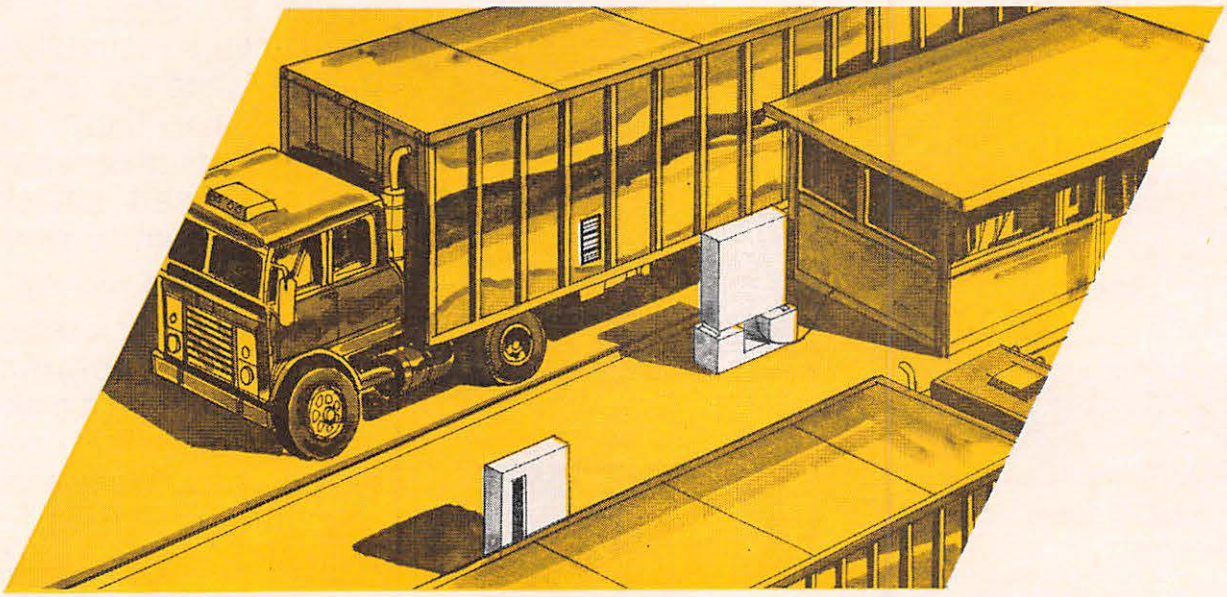
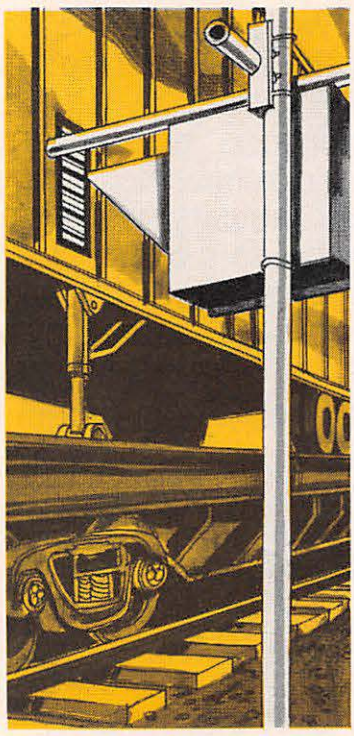
for an efficient piggyback terminal





2 New ACI Labels!

Take the Computer Identics Label!
it stands for leadership in remote label reading and control systems for the transportation and distribution industries.

Take the Intermodal Transportation Systems Label!
it stands for leadership in the development of special equipment that can be used interchangeably for rail, highway and water transportation; and for full service leasing of equipment and entire terminal control systems, (INTER-CON).

Take them both
and you have your 2+INTER-CON — Intermodal Terminal Control system — installed with no capital outlay, generating vital, real-time information that translates into better control, faster service and higher profits from the very first day.

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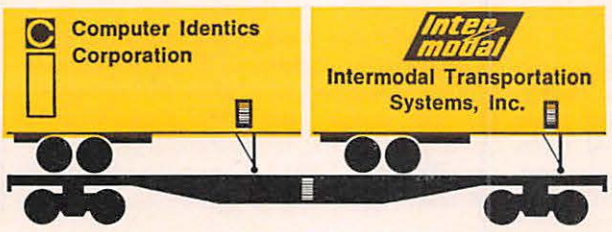


Circle 11 on reader service card

DSD issues I/O terminal specs

Specifications for a field input/output terminal have been developed by the Systems & Data Communications committee of the Data Systems Division, AAR. "The specifications will be used as the railroad industry guideline for a field terminal. They also include recommended performance standards which may be modified for a road's own particular need. The specifications are not to be considered as the industry's request for a price quotation," states DSD Executive Director Robert A. Petrash.

Here are these specifications:

General

1) This device will be designed specifically to meet the railroad industry's requirements for a dependable family of field I/O terminals capable of continuous operation both on and off-line for prolonged periods without maintenance. Such a device must be further designed to withstand substantial and continual external vibration and be immune to the dirt, heat and humidity normally encountered in the average railroad yard office. See environment section for quantitative values.

2) This device will communicate externally in 8-level U.S. ASCII code.

3) Should there be sufficient industry interest, the vendor should be capable of producing a 5-level Baudot code model of this device which would operate at speeds of at least up to 100 wpm.

4) Each I/O device will be a modular unit. Each device should be capable of on-line, off-line or off status independent of any other device. An option of simultaneous on-line/off-line operation should be available. If this option is used, the ability to attach more than one of each I/O device should be provided, as selected by the user.

5) It is desirable that options specified should be field installable.

6) Equipment should be available under lease and/or purchase, at the option of the customer.

7) It is extremely important that economical terminals be manufactured and produced. It should be stressed to potential manufacturers that a terminal built to these specifications should be built in several different models. This would pertain particularly to the control unit. It is felt that the control unit should be modular in design in order that the cost of a highly sophisticated unit needed at some locations would not be passed on to units used in a less demanding location.

1.0 Basic Terminal

1.1 *Line Interface*

(a) The line interface should be the basic unit on which a terminal can be configured.

(b) This interface must be capable of operating on an asynchronous line using an 8 unit code, plus one start and one stop bit.

(c) Speed of operation should be in the range of 110 to 600 bits per second.

(d) It must be possible to operate the terminal in half duplex mode, on half or full duplex circuits. As an option it should be possible to operate the terminal in full duplex mode with simultaneous two way transmission.

(e) It must be optionally possible to connect a minimum of two terminal systems at one location to this interface. These terminal systems would be polled or selected with a discrete sequence from the line and would share only the interface and data set.

(f) The interface must be EIA Standard RS 232-C and be compatible with common carrier modems and other standard manufactured data sets.

1.2 *Optional Line Interface*

(a) An optional line interface should be available which would operate on a synchronous line using an 8 bit code with no start and stop bits.

(b) Speed of operation should be in the range of 1200 to 2400 bits per second.

(c) Items (d), (e) and (f) of 1.1 also apply here.

1.3 *Control Unit*

(a) The control unit must be capable of line control using proposed U.S. ASCII standard line discipline as defined by USA Standards Committee X3 in following paragraphs: Paragraph 5.5 —Subcategory 2.4; Paragraph 6.3—Subcategory A3; Paragraph 6.5—Subcategory B2.

.1 Polling supervisory sequence of 3 characters.

.2 Selection supervisory sequence of 3 characters.

.3 Single or alternating acknowledgements.

.4 Longitudinal checking will be accomplished per Paragraph 4.3 of above USASCII specification.

(b) The control unit must be capable of ensuring that all transmitted and received characters are in even parity. Should there be sufficient industry interest, the vendor should be capable of producing an odd parity device. (Mark hold condition not detectable when in even parity and working point to point). (Standards Assoc. considering even parity for USASCII.)

(c) Selection of devices to be performed, as required, by line supervisory sequences.

(d) There may be simultaneous output to multiple output devices when transmitting, receiving or in off-line operation.

(e) Status of all units must be maintained such as, off line, ready, low paper, etc. Unique indications for abnormal conditions should be provided where practical.

(f) If longitudinal checking with immediate retransmission is used, the control unit must accept or initiate retransmission until the block is accepted or the computer forces termination.

(g) If longitudinal checking is not used, the control unit must cause a unique character to be substituted when a parity error is received.

(h) It must be possible to program for turnaround per block with or without longitudinal checking or per message when longitudinal checking is not used.

(i) It must be possible to accumulate and transmit or check longitudinal checking following unit separator without turnaround.

(j) A line activity indicator must be provided.

(k) There must be a capability to bypass line control to communicate directly with other terminals through communication lines.

(l) This unit should be modular in design and equipped only with those modules required to control the I/O devices selected for each terminal system.

2 0 Optional Building Blocks

2.1 *Line Buffer*

(a) Standard size 160 *data* characters minimum.

(b) Optional size 264 *data* characters minimum.

(c) Capable of data transfer to or from the line interface at any of the speeds listed in Section 1.

(d) Capable of high speed data transfer to or from the I/O buffer when implemented.

(e) Capable of data transfer to or from the device interface at the speeds specified in Section 3.

(f) When longitudinal checking with retransmission is used, the buffer must, of course, be non-destructive read. If price of destructive read buffer is significantly less, it should be available for systems not requiring immediate retransmission.

(g) It must be possible to clock this buffer at different speeds for line or various devices, however, it is understood that simultaneous transmission to two or more devices requires that they operate at the same speeds.

(h) Optional capacity for an additional buffer for full duplex operations.

(i) When loading buffer from an input device it must be possible to obtain maximum utilization while guarding against buffer overrun. A buffer block would normally contain several sub-blocks or records separated by a unit separator character.

2.2 *I/O Device Interface*

(a) An interface which would allow connection of input or output devices and will permit additions of future improved devices, with minimum change to basic terminal configuration, is desirable.

(b) Some portion of this interface will be basic and common to buffer(s) and all I/O devices.

(c) The portion of interface dealing with the device should be modular and implemented per device. A given unit should be equipped only with those modules required to control the I/O devices selected for each terminal system by the user.

(d) Method of data transfer should be parallel by bit, serial by character. Serial to parallel or parallel to serial converters should be available for those devices requiring serial operation.

(e) This interface in conjunction with the control unit (1.3) should have full control of buffer(s) and I/O devices to ensure complete protection of data within the terminal.

(f) This interface must be equally applicable to the line buffer or the I/O buffer. When I/O devices require program control (editing, validating, off-line printing, etc.), the device interface may be connected to the I/O buffer. (Alternate A). When I/O devices do not require program control (on-line report printing, transmission of pre or unedited data, etc.), the device interface may be connected to the line buffer. (Alternate B).

2.3 *I/O Buffer*

(a) Standard—two 80 data character buffers minimum.

(b) Option—two 132 data character buffers minimum.

(c) The capability for back-space and error correction must be included in the input buffer whether or not edit and format programs are used.

(d) Any buffer to buffer transfer must be sufficiently rapid, that operation to alternate devices within the terminal will not be delayed.

(e) Capable of data transfer to or from the I/O device at the speeds specified in Section 3.

(f) Optional capacity for an additional set of buffers for simultaneous on line-off line operations.

2.4 *Program and Format Control of Local I/O Devices*

(a) Standard capability for one program.

(b) Optional capability for three additional alternate programs.

(c) Programs must be loadable from any input device and also from the communication line.

(d) Programs will operate on data entering the I/O buffer.

(e) Functions of the programs will be definition of field length; alpha, numeric, or alphanumeric definition; insertion of fixed data characters; deletion of characters or fields; insertion of control characters; left space and left zero fill; etc.

(f) Violation of program should cause alarm and inhibit input until correction procedures are followed.

(g) It must be possible to switch to the required stored program by the first character of a record, to be specified by the customer.

(h) When using keyboard, escape from program control must be possible to allow free formatting. (Option)

(i) Each I/O device will be independently responsive to the control characters.

(j) Control characters will serve such purposes as record separation, start of message, End of Message, End of Text, End of Block, Delete Data Character, Printer Alignment Functions, Punch Control Functions, Reader Control Functions, etc.

3.0 I/O Devices

(a) All punched card equipment specified will be standard Hollerith coded 80 column cards.

3.1 *Design*

(a) Design and development of new devices should be directed toward filling the gap between low and medium speed equipment lines presently produced.

(b) A complete line of I/O devices with a minimal speed of 10 characters per second and up to an optional speed of at least 120 characters per second will be required.

(c) Adaptation of existing lines of equipment to suit the requirements of this specification should be given serious consideration.

(d) Each device should generate appropriate control characters of the type mentioned in 2.4 (j).

3.2 *Speed of Operation*

(a) It should be possible to use I/O devices of any speed by providing the correct clock rate through the device interface for any particular device.

3.3 *Keyboards*

(a) Communication typewriter with upper case U.S. ASCII.

(b) Conventional type keypunch keyboard optional or additional.

(c) Display and any control keys/switches to be separate module, independent of the keyboard.

(d) Mechanical and/or electronic indicators should be available to show the following information: characters indicating current keyboard position; identification of stored program level currently controlling keyboard; if I/O buffer available, display of the data character in the current position.

3.4 *Card Reader*

(a) Must read punched holes—basic; mark sense information—optional.

(b) High speed skip and eject under program control (for low speed readers).

(c) Capable of unattended operation.

(d) 500 card hopper and stacker—basic, 2500 cards—optional.

(e) For low speed readers, a control punch should be provided to permit fast skip and card release if such a punch is sensed in any data card. The position of this control punch, when used, may be variable within a deck of cards to be read.

3.5 *Tape Reader*

(a) To read fully punched (Chad) centre feed tape.

(b) Capable of reading continuous or torn tape.

3.6 *Printer*

(a) Sprocket feed capable of moving 6 part paper—basic; additional parts—optional.

(b) Print positions 72 characters minimum, 132 characters maximum.

(c) Vertical forms control.

(d) Optional horizontal forms control.

(e) Optional two color printing (serial printers only).

(f) Ten characters per inch horizontal.

(g) Six lines per inch vertical.

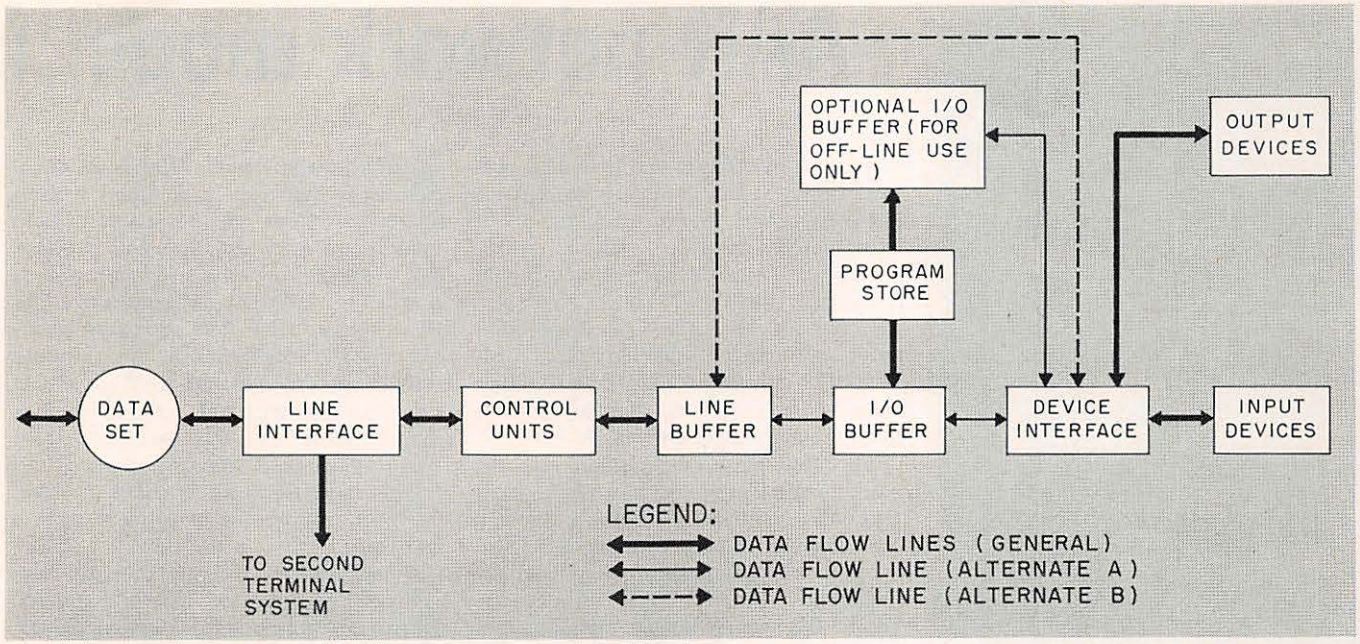
(h) Upper case U.S. ASCII print set.

(i) Optional OCR 'A' type font.

3.7 *Card Punch*

(a) High speed skip, eject and register.

(b) Interpret all 80 columns above corresponding punches. This requirement does not apply at speeds beyond



GENERAL CONFIGURATION of the proposed field input/output terminal.

which it is no longer practical to interpret without slowing the punching.

(c) Capable of off line keypunching, using keyboards specified in 3.3 (a) and (b).

(d) Capable of unattended on line operation.

(e) 500 card hopper and stacker—basic, 2500 cards—optional.

3.8 *Tape Punch*

(a) Fully punched (Chad) centre feed tape.

(b) Equipped for automatic tape feed out.

(c) Option—typing variety for low speed punches.

3.9 *CRT Unit*

(a) Display 80 characters on one line—minimum, additional lines—optional.

(b) Non-destructive cursor.

(c) Optional multi color display.

(d) This unit should contain the circuitry to maintain its own image.

3.10 *Magnetic Tape*

Optional capability for handling of cassette type magnetic tape shall be provided.

4.0 Environment

This device must operate on 120-volt plus or minus 10%, 60 Hertz plus or minus 1 Hertz; AC single phase; and 3-wire, including ground. Suitable protective circuitry will be provided in the AC input to the unit power supply(s) to prevent degradation of operations or destruction of unit components caused by power surges, spikes, and other transients in the AC power source. Satisfactory operation must be maintained through the temperature range of 40° to 120°F, the humidity range of 0 to 95%, and in an industrial, non air-conditioned or filtered location. Many units must operate satisfactorily when subjected to vibration transmitted from trains passing in the area. Printing, reading and punching units shall be optionally soundproofed. The unit must be as compact as possible. Human engineering should be included in the design of the terminal to insure ease of operation, and to encourage accurate performance of manual functions.

5.0 Maintenance and Reliability

5.1 *Maintenance*

The vendor, if requested, must contract to provide maintenance support to all terminal locations, 24 hours per day, seven days a week, including all holidays. Maintenance personnel must be so located that they will arrive at a defective terminal location within an agreed upon time after being called. Total outage of all units in a terminal complex must not exceed 1% of total system operating time per month. Any unit which is out of service because of failures in excess of 20 hours in a 60-day period will be considered unsatisfactory and must be replaced, at the railroad's option, with a new unit within 15 days after the 20 hours has accumulated. A formal preventative maintenance procedure and schedule must be established and implemented for all units. Parts such as fuses, lamps, ribbons, paper, etc., must be simple to replace so that these replacements can be made by non-technical personnel.

The vendor may elect, with user's permission, to provide on site stand-by equipment in lieu of 24-hour support.

The interconnection between all units, including spares, must be on a plug in basis so that non-technical personnel can replace defective units.

The supplier shall be required to warrant that repair parts will be kept in stock at all times and for a period of 10 years after date of sale of the last machine of a certain model. Manufacturer shall be required to furnish complete detailed instructions, maintenance and adjustment manual together with parts list showing assemblies as well as individual parts for each element of the I/O Device. Wiring diagrams describing strapping options, etc., shall be furnished where required.

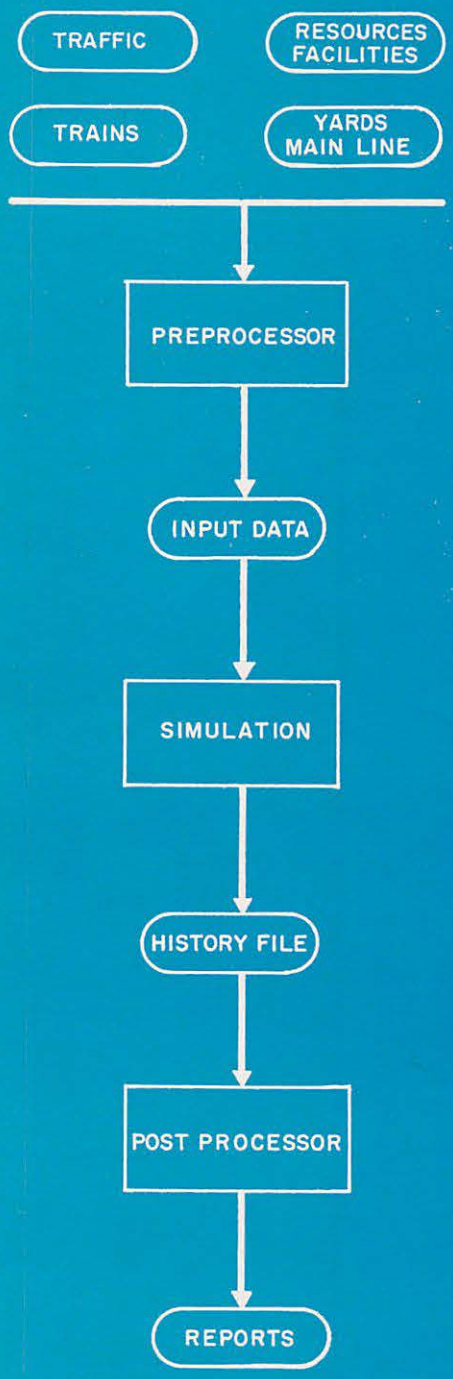
Diagnostic procedures should be incorporated within the terminal so that testing can be accomplished off-line.

5.2 *Reliability*

The individual units comprising any terminal complex will normally be operated throughout 24 hours daily, 7 days a week. Any downtime in the units will have a serious adverse effect on data collection and distribution at the terminal location and on the railroad as a whole. For this reason, equipment reliability is of paramount importance.

To provide the reliability required for this terminal, a mean time between failure for electronic units and for the electronic portion of electro-mechanized units of 20,000 hours and for the mechanical portion of electro-mechanical units of 2,000 hours is desirable.

AAR network model is



Several railroads have developed network models for simulation of operations. However, most are tailored to fit individual railroads. A railroad industry network simulation model is being developed by the Midwest Research Institute for the AAR. The stored computer programs, written in SIMSCRIPT, are now in the validation stage. The model is due for release to member roads in December 1970.

The following description of the model, and the philosophy of its creation and operation, is essentially the full text of a paper presented at the Third International Symposium on Railway Cybernetics in Tokyo. Authors are W. K. Minger, manager, data systems special projects, AAR; J. N. Cetinich, manager, analytic services, Southern Pacific; and W. R. Benson, assistant director, economics and management science division, Midwest Research Institute.

American railroad operating procedures have evolved to their present state through many years of trial-and-error experience. The change from steam to diesel power provided a tremendous opportunity to dramatically improve operations in addition to being a more effective type of locomotion. Other technological improvements such as centralized traffic control, welded rail, computer-controlled functions and computer-assisted analysis further influenced these operating procedures. One of the side benefits of this technology has been the improved atmosphere for accepting change, which has provided an impetus to analyze the entire system of railroad operations.

While analytical techniques of operations research have been used in the railroad industry, generally they attack very limited segments of our operations, such as design of a given yard, increasing the capacity of railroad, improving unit train operations. Because of the large number of variables and particularly the extensive interaction between these variables, no optimization technique has been satisfactorily applicable to a system network investigation. Simulation does provide the means of investigating the consequence of change. This leads to a better understanding of how the system can be improved and enables testing the improvements before actually implementing them.

Some notable efforts in simulating portions of the operating system have already been achieved. Models of terminals, over-the-road, and diesel assignment operations are examples. These models are very detailed and descriptive of those functions and are useful to problems which can be investigated in those terms. They fail, however, in describing the interaction of one terminal with another, over-the-road influence on adjacent terminals, diesel assignment interaction with car throughput performance, etc. What is needed is a model representing the entire railroad operating system to investigate system problems.

Some railroads have already developed their own network model. However, each model has been tailored to that railroad's own immediate needs. It became apparent that the more prosperous railroads were developing this powerful aid for themselves at a considerable expense with many others comtemplating such development in order to take advantage of this capaability. Recognizing this and the fact that many roads could not afford such an expensive undertaking, the Association of American Railroads through its Analytical Techniques Committee of the Data Systems Division undertook the development of a general Railroad Network Simulation Model. Furthermore, the AAR model was to use the experience with existing models as a basis for developing advanced techniques to minimize computer costs; to have capability of representing components at different levels of detail; and to maximize user convenience.

The specific objective of the AAR Network Project is to produce a model that will permit study of strategies of classification or blocking, changes in schedule, major changes in facilities, and train operating policies. The model will be programmed in a modular form to facilitate modification for needs of individual users. Raw output of the model will be a detailed history of the simulation so that users may create reports in addition to the standard report set provided.

Since it was felt that most railroads would run the model at computer service centers rather than on their own property, it is intended that the model be as computer independent and efficient as possible. As such, the model is being programmed in SIMSCRIPT, a general simulation language, and will be operational on three different computers—the CDC 6400, UNIVAC

almost done

1108, and the IBM 360/65. Running time on a CDC 6400 will not exceed one hour of machine time to a week of real time for a network of 100 nodes, 100 trains a day, and 5,000 cuts of cars.

Specifications also included a requirement that the acceptance of the model will require validation with live data on the Control Data Corporation models 6400 or 6600, the UNIVAC 1107 or 1108, and the IBM 360/65 computers. The contractors will also provide three one-week training sessions: one at Washington, D.C., one at Chicago and one at Kansas City. The contractor will also guarantee program maintenance for one year after the model has been accepted.

It is not feasible to simulate the entire spectrum of railroad operations in a single model and still remain within the prescribed constraints of computer size and running time. That portion of the "real world" which is modeled in the simulation is described below.

Cuts are generated at yards or nodes based on historical data or a planned traffic generation pattern as desired by the user. A cut is a group of cars with like origin, destination, traffic class, and origination time. These cuts are then processed through such functions as icing, movement from one area to another within the yard, classification, etc. Cuts are assembled and assigned to trains, and trains move to destination, experiencing delays or expedited movement. Trains may be scheduled, or traffic actuated. Upon arrival at a destination, trains are inspected and other similar operations performed, cuts may be set off, connections with other trains may be made, and additional cuts may be picked up. The links over which the trains travel may be single or multiple track and, on occasion, trains may meet or pass other trains.

The following assumptions are made relative to railroad operations to be simulated within the network model:

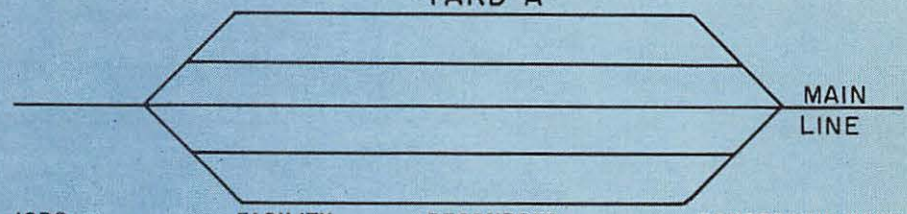
(1) Motive power crews and train crews are also beyond the scope of the model and are not included; however, absolute train connections can simulate required crew transfers.

(2) Accidents and environmental effects such as weather conditions, track damage and repair, etc. are not included in the model.

(3) Upon the arrival of the train at a destination, cuts are set off in the receiving area and occupy that area resource for a time delay which is equiva-

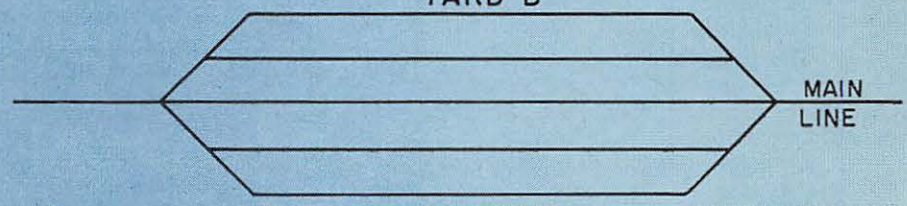
HOW YARDS ARE REPRESENTED IN A NETWORK

YARD A



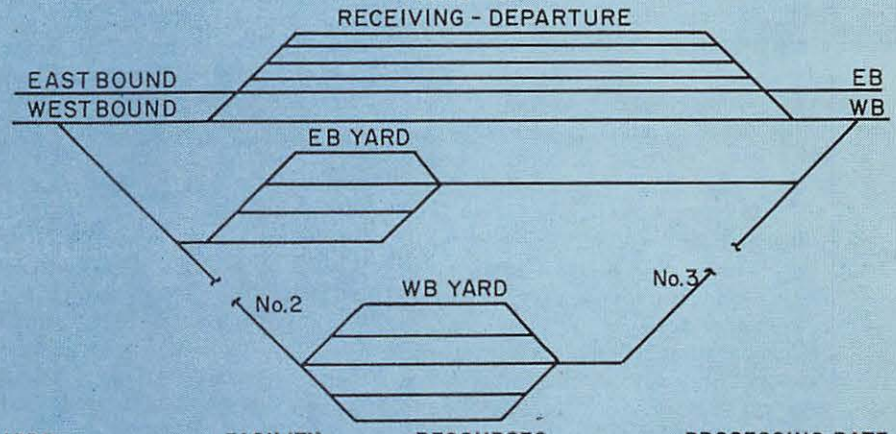
JOBS	FACILITY	RESOURCES	PROCESSING RATE A(X) + B	
Inspect	Yard	Insp Crew	.20 cars	
Classify	Yard	Engine	0 cuts	20
Assemble	Yard	Engine	.35 cars	15

YARD B



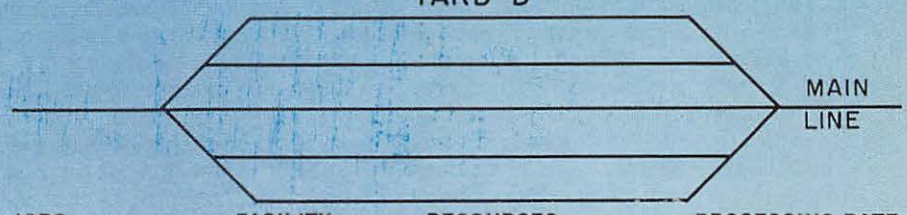
JOBS	FACILITY	RESOURCES	PROCESSING RATE A(X) + B	
Inspect	Yard	Insp Crew	.33 cars	
Classify	Yard	Engine	.50 cars	10
Assemble	Yard	Engine	10.0 cuts	10

YARD C



JOBS	FACILITY	RESOURCES	PROCESSING RATE A(X) + B	
Insp Inbd	Receive	Insp Crew	.25 cars	
Classify EB	Eastbd	No. 1 lead, Eng (to left of EB yd)	1.00 cuts	10
Classify	EB, WB	No. 1 & 2 leads Engine	1.00 cuts	10
Assemble	Transit	No. 3 Engine	.20 cars	
Insp Outbd	Depart	Insp Crew	.30 cars	

YARD D



JOBS	FACILITY	RESOURCES	PROCESSING RATE A(X) + B	
Inspect	Yard	Insp Crew	.33 cars	
Classify	Yard	Engine	.50 cuts	10
Assemble	Yard	Engine	.25 cars	20

lent to the time required to move cars to their ultimate destination. After this delay, the cuts then disappear from the simulation.

The railroad network model consists of three modules, preprocessor, main simulation, and postprocessor.

The preprocessor module: The preprocessor as its name implies is intended to be run as a separate job independent of the main simulation. The function of the preprocessor is to accept all input data and prepare it for use in the simulation. During this process, the preprocessor also functions as an edit program to determine if all required data cells are filled, the network to be modeled has connectivity, data values are within specified bounds, and that the values are in the proper format for the simulation.

The preprocessor will require input information from the user concerning the railroad system to be simulated. Data will include the following:

(1) *Nodes (yards or terminals):* Identification, jobs which can be performed at the nodes, resources available, rates at which jobs are performed, classification and blocking policy of the nodes, etc.

(2) *Links (mainline tracks):* Connectivity between nodes, meet, pass, and conform time, time and tonnage relationships to compute minimum travel time.

(3) *Trains:* Identification, schedules, special limitations (tonnage, and travel time), jobs at the nodes, permissable traffic to be carried from each node, frequency of operation, type, and connection specifications.

(4) *Traffic:* Specification of deterministic of stochastic generation of strings of cuts at nodes.

The inputs of the preprocessor will be used to construct the initialization package required by SIMSCRIPT and the exogenous input for the main simulation module. To provide additional flexibility, the output of the preprocessor (which is the input to the simulation module) is planned to be on three input units. Node and link initialization data will be on Unit A, the train information on Unit B, and traffic origination data on Unit C.

The main simulation: *Yard operations.* No two terminals are alike. Each one has a unique layout, traffic flow, and resource availability. In order to allow the user the flexibility necessary to model the yard operations in his system, the AAR Network Model requires input defining the jobs which can be performed at each complex node, the resources which are needed to perform each job, the availability of resources (which can fluctuate due to shift changes), and the classification logic used at each yard.

By virtue of the limited resources, delays are generated in the terminals leading to congestion and deviations from schedules throughout the system. The interaction of these delays, along with delays due to meets and passes, replicates the delays found in the real world system.

The flexibility of the model is increased by the ability to alter the sequence of jobs. Each train owns a task list which provides all information necessary for the train to follow a route through the system and have jobs performed in the same order that they are performed in the actual system.

In addition to the definition of complex terminals, the user may also define "simple" nodes which have no competition for resources and no ability to classify. The sequency and types of jobs to be performed are as flexible as for complex nodes, although no delays are created due to unavailable resources. The inability to classify implies that traffic may not originate at simple nodes and all traffic set off must terminate.

The assembly job is performed in response to the anticipated arrival of a train which is to pick up cuts. The number of cars to actually be picked up is dependent on the capacity of the train and the tonnage and number of cars remaining on the train. Cuts being assembled are removed from the classification groups at the yard and placed in the consist of the number of groups to be pulled and the number of cars assembled.

The timing of assembly is accomplished by a "scan." The time required for assembly of the cars currently at the next complex node is compared to the time required for the train to be ready to make the pickup. If assembly would be premature, a new scan time is calculated and the process repeated. Otherwise, assembly is begun subject to resource availability. This logic tends to reflect actual traffic assignment and resource utilization.

Connections, either absolute or conditional, are established between pairs of trains by the user. Conditional connections specify an acceptable delay as well as the classification group of the traffic. Absolute connections can be used to simulate motive power or crew connections.

Train and cut operations. The task list, as mentioned earlier, is the backbone of this simulation. It indicates what is to be done to each train and the order of performance. Underlying the performance of each of the task list jobs is the concept of resource allocation. Resources such as crews, facilities, leads, yards, etc., as well as their availability, requirement, and processing rates are specified by the user. Following is a discussion of each of the task list jobs currently in the model.

Train origination. Trains originate at specified nodes either empty, or preconsisted. Extras and second sections may be generated as well as regular trains.

Pickup of cuts. Cuts which have been classified into groups according to the classification policies of each node are picked up as blocks based on preferences indicated by the trains' task lists. At the time of pickup, the point of set off for each block is specified so that the set off point can be a function of the pickup point as well as the ultimate destination of the cuts. Time required for pickup is a linear function of the number of cars picked up.

Departure. The time required for the train to traverse the next link is calculated as a linear function specified by the user for the tonnage carried on the train. Trains will depart upon completion of all jobs unless the departure

Railroads pass

Railroads are working together, especially in the area of operations research. Evidence is the applications digest of the Committee on Analytical Techniques of the Data Systems Division, AAR. The present edition consists of abstracts of 111 computerized applications of operations research used or under development by 16 railroads.

Each program is described in an abstract which consists of the program title, developer, an application description, person to contact for further information, publications containing information about the program, and comments. A program on capital expenditure evaluation, for example, is described as "a calculation of a range of possible rates of return on an investment proposal. It is used as an aid to making investment decisions." Under comments, the abstract reports that the program is written in RAX Fortran for time-sharing on an IBM 360/50, and the method used is the discounted cash flow return on investment concept.

Sixteen programs deal with the service aspect of railroading, and the number is larger if programs covering motive power utilization and network models are included. Seven railroads have supplied abstracts concerned with network models, and 11 on train performance calculators. One TPC pro-

time is denoted such that the train may not depart ahead of schedule.

Arrival at intermediate simple nodes. Links between complex nodes may include one or more intermediate simple nodes capable of performing jobs at fixed rates on trains and terminating all cuts set off.

Arrival at complex nodes. The execution of the arrival routine requires adjustment for meets and passes which may have occurred on the preceding link. If meets or passes have occurred, another arrival is scheduled based on the delay incurred by the train in question. When the actual arrival time is determined, the arrival times at each of the preceding intermediate, simple nodes are calculated.

Inspection. Inbound and outbound inspection simulate the inspection procedure, minor repairs on a stochastic basis, and if desired, the completion for space in the receiving or departure yard, and bleeding or charging of the trains. The time required is a linear function of the number of cars in the train.

Set off. Cuts are set off as blocks at the nodes specified by the task list. The blocks are placed in the consist of a string. While the train continues on its route according to its task list, the string begins processing through the node according to the task list segment transferred from the train to the string.

Special functions. Any number of special functions such as piggy-back or icing may be specified by the user. Times required for special functions are linear relationships based on the number of cars.

Classification. Cuts are classified into groups based on their ultimate destinations and traffic classes. The user defines the various groups according to the logic used at each of the yards being simulated. The time required for classification is a function of the number of switches required and the number of cars classified.

The postprocessor module: Conceptually, the postprocessor will utilize the simulation history tape that will be generated by the simulation module. Several standard reports will be provided. The postprocessor will contain information on all activity during the simulated period, and it will be possible to combine these data for presentation in any manner desired by the user. Hopefully, the user will be able to incorporate his own data with the simulation data so as to provide a cost analysis of the operating policies which are simulated.

The model, because of its flexibility, will allow either a gross representation or a more detailed one, depending upon the nature of the investigation. We expect that many roads will want to use the model to determine the interactive efforts of adding a major facility such as a large yard or a by-pass line. Others will want to assess the effects on the existing system due to increased traffic demands, either in volume or level or service. Probably the most consistent use of the model will be the testing of changes in operating policies, both near term and long range.

The model will yield useful information which can assist in improving railroad operations.

on information about analytical techniques

gram covers determination of mid-train forces when using slave locomotive operation. Some of the other programs include:

—Shipper siding to consignee siding time determination.

—Empty freight car distribution.

—Car requirements forecasting.

—Flow rules for movement of empty equipment.

—Traffic forecasts.

—Print short line mileage tariff.

—Terminal service evaluation.

—Total terminal control including design of classification yards.

—Determination of terminal performance standards.

Management and planning areas are represented by about a dozen programs ranging from revenue forecasting to capital investment analysis. Other programs included in the digest are profit on traffic summaries, investment tax credit analysis, lease or buy analysis, project planning and control, operations planning model dealing with train running times vs. operating costs, management of material inventory, and machinery purchase economics.

For the operating officer, there are at least nine programs dealing with line capacity, centralized traffic control and dispatching. Operations, of course, would be concerned with terminal performance and network models.

The eleven programs concerned with maintenance of way and engineering functions range from cut and fill calculations to bridge repair and renewal. Others are costs of laying new and relay rail, rail wear analysis and oversized loads for clearance restrictions.

Of the 12 programs included in the digest covering the motive power area, four are concerned with component or diesel unit failures and analysis of such failures. Inspection and maintenance scheduling are also covered by three programs. Locomotive usage and train performance is another program which has the combined interest of motive power and operating officials.

A sampling of the other programs shows the wide range of interests and problems represented:

—Production control for freight car manufacturing.

—Statistical sampling for train-off and merger studies.

—Communications network cost model.

—Statistical regression analysis.

—Statistical evaluation of loss and damage claims.

—ACI scanner cost site selection.

—Inductive interference factors from parallel power lines.

—Warehouse location program for determining shipper distribution patterns.

—Train crew assignments with minimum cost analysis.

The 111 programs now in the digest do not, of course, include all that are being used, developed or could be made available. Railroads, other than those represented on the analytical techniques committee are urged to send applications to R. L. Sauder, chairman, Information Exchange Subcommittee. There is an incentive to do so because of the "unbundling" of IBM and other computer manufacturers. They now charge for programming development and assistance. Thus, by sharing programs, railroads can eliminate duplication of effort and reduce programming costs.

First publication of the applications digest was in June 1969 with a supplement printed this last spring. Another supplement is expected to be available at the Data Systems Division annual meeting in Atlanta, Sept. 28-30. New items to be added in the forthcoming supplement include: (1) a keyword-in-context index for the updated digest; (2) a list of periodicals and journals relating to analytical techniques; (3) a list of inactive and deleted abstracts; and (4) new and/or updated abstracts. about analytical techniques.

For more information, and availability of copies of the application digest, contact Robert A. Petrash, executive director, Data Systems Division, AAR, American Railroads Building, 1920 L Street, N.W., Washington, D.C. 20036.

Raco has served for 50 years

After half a century, 60% of its products were not available 10 years ago from Railroad Accessories Corp.

Small enough to be well-known by its customers, yet large enough to increase its product line through internal development and design. Fully 60% of its current products were unavailable from Railroad Accessories Corp. only 10 years ago. "Raco" is now enjoying its 50th anniversary.

Also, Raco has the unique distinction of being well known by its presidents. Prior to November 1958, the words "Raco" and "Fred Lavarack" were synonymous. Since that time the two words have been "Raco" and "Harry Scott". The former chief signal engineer of the New York Central is certainly as well known today as his predecessor.

Raco's steady growth is largely due to the direction taken by its leaders. Scott has continued the work of founder Lavarack, particularly in working closely with customers to solve their problems and answer their needs. "My philosophy", says Scott, "is not complex. I believe that the railroad industry is a vital and necessary part of our nation. If my company can contribute something of value to this necessary industry, we have a valid reason for being. Therefore, our mission is to seek out our customers' needs to the end that we can offer them satisfaction of those needs on an economical and timely basis and to do this in such manner so as to permit our own growth in breadth and depth."

How Raco has met customer needs can be briefly told in its history. Founded in 1920, the company was a supplier of track circuit accessories, that is, rail bond wires, connections, cable risers and housings. Later Raco added lightning arresters, resistors and rail bond drills to its product line. In the early 1950's, Raco marketed a power operated track wrench. In 1964, Raco made its entry into the field of highway-crossing protection devices and systems by acquiring Griswold Signal Co., and its wholly owned subsidiary, Transport Products Co. Last year, Raco was acquired by CCI Corp., whose subsidiary, Marquardt Industrial Products Co.'s product line (notably the Grade Crossing Predictor) nicely complements the Raco product line.

Raco's growth has been the result of planned policy. Says Scott: "It has been our policy to promote this growth as much as possible by enlargement of our product line by internal development and design, and where opportune, by acquisition of a company or companies engaged in our own field and which complement our own experience and know-how. We feel that Raco has been a contributor of some value to the railroad signal business and its constantly increasing need for technological improvement and economic application."

"The railroad industry is a vital and necessary part of our nation."

Harry Scott

Raco's pioneering development has brought forth the following products to meet customers' needs:

- —Surge protective devices for solid state equipment.
- —Automatic temperature compensated battery chargers.
- —Modular cast aluminum wayside signal.
- —Lightweight crossing gate and hydraulic gate mechanism.
- —Unilens signal employing fibre optics for the display of multiple color aspects through one lens system.

These are just a few of Raco's engineering achievements to aid the industry it serves to do its job at less cost.

Scott can well appreciate the customers' continuing search for products to do more for less, especially when he was a Raco customer as signal engineer for the New York Central. He was born in Findlay, Ohio on Oct. 27, 1908 and graduated from the University of Cincinnati Evening College, where he took courses in electrical engineering and business administration. He joined the New York Central as a signal helper in 1928. Later he was promoted to signal maintainer, leading signalman in construction work and then to signal foreman.

In 1940, Scott was appointed signal draftsman at Cincinnati, later being promoted to circuit engineer. In 1950, he was appointed assistant signal engineer, Lines West, at Cleveland. Three years later, Scott was promoted to assistant chief signal engineer system, and in 1955 to chief signal engineer, system. He was active in the Signal Section, AAR, serving as a committee chairman and also on the Committee of Direction.

Having this background in the railway signal field, it was natural that Scott would be elected to succeed Lavarack as head of Raco. Scott said that it certainly was different being on the "other side of the fence" in that he was now a manufacturer, but he felt that his experience with NYC had been a tremendous help to him.

As for the future, Raco will certainly continue its growth, and with Mipco be able to produce total control and operational systems for railroads. "This future, is evolutionary, not revolutionary," says Scott. "The mechanics of railroad operation will become increasingly automated with remote and supervisory control involving new and more complex technology in such controls.

"In the past, the products of the industry to supply such systems and controls have been available well in advance of the railroads' acceptance to use such systems and controls. This situation now exists and I expect it to continue," Scott predicts.

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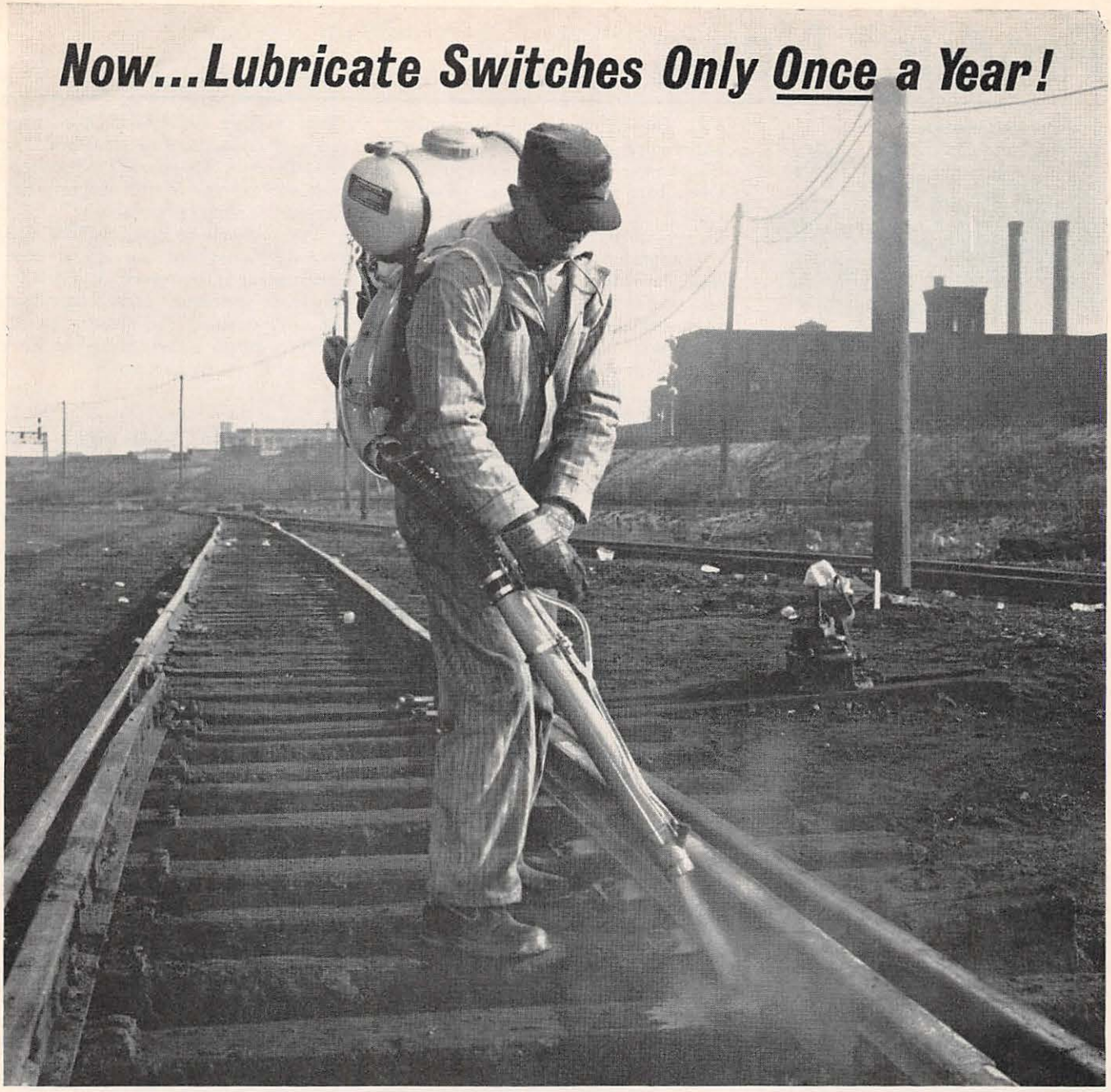

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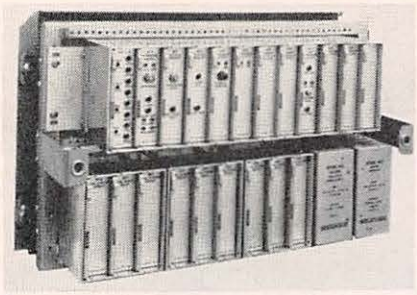
Product News



Selective signaling has privacy feature (128)

The type 47B SS1A selective signaling has a privacy feature that excludes all stations not specifically dialed by the call originator and applies a busy tone toward excluded stations for the duration of the call. Selected stations can be equipped for privacy override. Intrusion is a feature available with the privacy system to allow those stations equipped to enter the conversation. A low level tone alerts those parties on the established call as to the presence of an intruder. The apparatus case for the 47 assembly has a capacity of up to 6 stations and 12 codes. Each station has the ability to select any of the 81 available network codes on a manual or automatic privacy basis. *Wescom Inc.*

Computer terms can be learned (129)

In the field of electronics, "byte" is a term that refers to a sequence of binary digits (such as 00110) which are usually acted upon as a unit by a computer. This and more than a hundred other esoteric words coined by the computer industry are defined in a new brochure. "Glossary of Commonly Used Computer Terms" covers the word gamut from "access time" to "zero suppression". Definitions provide cross references, synonyms and/or antonyms, and table illustrations where necessary. In defining abbreviations, root words are given in addition to the explanation. For instance, "FORTRAN: Formula Translator. The language for a scientific procedural programming system." *General Automation Inc.*

Computer usage firm aids railroads (130)

A system of computerized car tracing has been developed that should aid in car utilization and distribution. The system would automatically notify appropriate operating personnel if and when cars miss connections, or when cars are off schedule. Periodic reports on yard performance would be generated.

Commodity flows for several railroads have been developed by Xenex, specialists in computer usage. The computerized car tracing system was developed in cooperation with Systems Analysis & Research. Xenex also performs airline origination-destination studies. *Xenex Corp.*

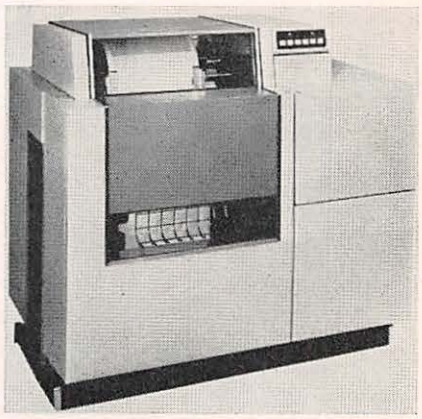
Mini-computer is for data communications (131)

A new minicomputer, model 2114B, priced at $8500, is less than any previous HP computer. The 2114B features a direct memory access option, which costs $1500 and provides a high-speed data channel that's assignable under program control to any of the computer's seven input/output channels. Multilevel priority interrupt is standard. An optional 56-channel multiplexed I/O system is available, and the high-speed data channel can also be had with the multiplexed I/O. According to HP, the new computer is designed for data-communication, instrumentation, and educational systems. Model 2114B has a memory capacity of 4096 16-bit words, expandable to 8192, and a memory cycle time of 2.0 microseconds. *Hewlett-Packard Co.*

New data set is a low-speed device (132)

The Rixon FM-18 data set is a low speed modem (up to 1800 bps) intended to link peripheral units such as CRT displays or card and tape terminals to a central processor. It will operate at any speed up to 1800 bps, when used as an asynchronous modem. A synchronous option is available, making the FM-18 have fixed rates of either 1200 or 1800 bps. The FM-18 is a frequency shift keyed modem for use in full duplex, half duplex, or simplex operations.

An optional reverse channel provides simultaneous low speed communication in the reverse direction for channel assurance, break signalling, or error control. The FM-18 consists of three cards, making it easy to stock spares. *Rixon Electronics Inc.*



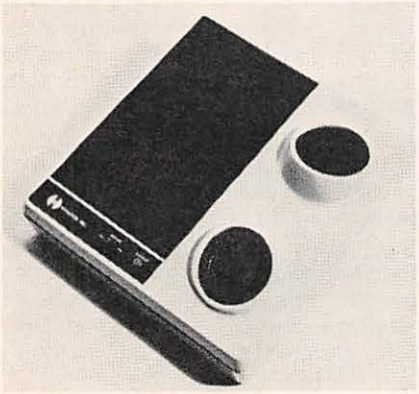
Printer operates at 1500 lines/minute (133)

The EM-C5 high-speed line printer is available to operate at 1500 lines per minute providing alpha-numerics in a 48-character set. Using numerics only in a 13-character set, the EM-C5 can print 3,000 lines per minute. The unit has a capacity of 132 or 160 columns with spacing set at 10 columns per inch. Vertical spacing is 6 or 8 lines per inch. Solenoid-operated hammers have sufficient energy to provide excellent print quality for up to 10-part forms. *National Cash Register Co.*

Narrow band modem works at 4800 bits/sec (134)

The 48/QM narrow-band 4800 bits per second modem has been designed to provide superior performance over typical, readily available voice-grade telephone lines. Using

new design concepts, a reduction to a signaling bandwidth of 1200 Hz has been achieved which significantly improves tolerance to variations in telephone line conditions. System checkout or maintenance procedures use built-in test aids. *ESE Limited*



Data couplers work in acoustic mode (135)

The DC-102 series of data couplers, which in the acoustic mode have the sensitivity and noise immunity of a direct-connected data set such as the Bell 103A, can operate with any EIA compatible terminal or Teletype printer by using the side-by-side rear connectors. This permits simultaneous operation of a Teletype printer and EIA compatible devices such as a plotter, CRT display etc. The DC-102A is an acoustic coupler only while the DC-102 AD has a third rear input connector which makes it possible to operate the coupler as a direct connected data set merely by throwing the "Acoustic-Direct" switch.

The main features include: half or full duplex operation; high dynamic receiver sensitivity: acoustic mode—−50 dBm, and direct mode—57 dBm (DC-102AD only); high noise rejection through the use of selective amplification and multi-sampling techniques; an advanced missed carrier detector which causes the coupler to remain off in the presence of high room noise, and delays the transmitter turn-on for 3.5 seconds to allow for manual handshake sequence; and a carrier detection system which provides a visual indication when the signal being received is capable of producing valid data. *Novation Inc.*

Service provides path loss test for mw (136)

A path loss testing service provides a sure method for proving true microwave path performance prior to energizing the system. Path tests are

(Please turn to page 58)

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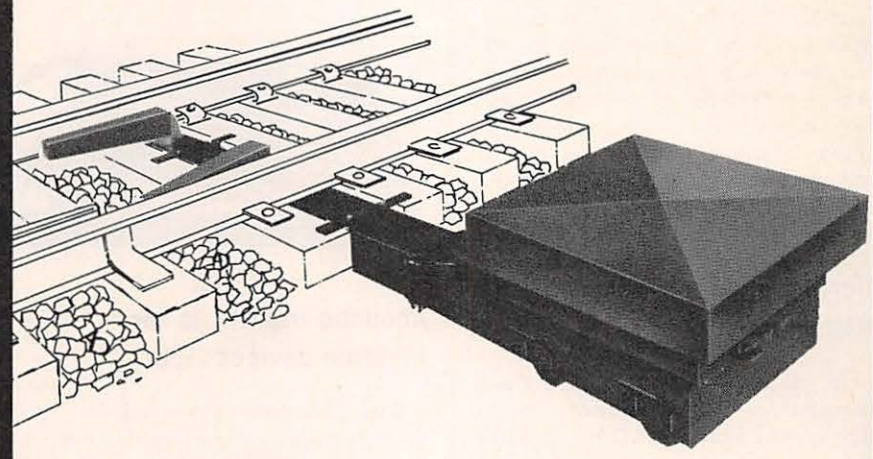
RAILS COMPANY HAB SWITCH HEATERS



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All components located for easy installation and servicing - separate remote control panel is free from trackside vibration. Hot air duct is electrically insulated against track circuit interference and designed to provide maximum air flow.

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13007

Circle 24 on reader service card

PRODUCT NEWS

(Continued from page 57)

conducted at frequencies that will accommodate future heavy route requirements of the customer. Radio and power equipment have been installed in facility vehicles for transport to any location in North America. The basic equipment also includes especially designed antennas and carriage assemblies for mounting to clamp-on test tracks and existing towers, or elevator erection system towers where no towers exist.

Path loss testing is a vital tool in pre-evaluating the effect of known or suspected local atmospheric conditions, such as inversions and ducting. Surface reflections that could cause phase cancellation or attenuation resulting in signal loss can be tested, methods for overcoming the problem analyzed, and data provided for a solution. *Microwave Systems Co.*

Microwave operates in 2GHz band (137)

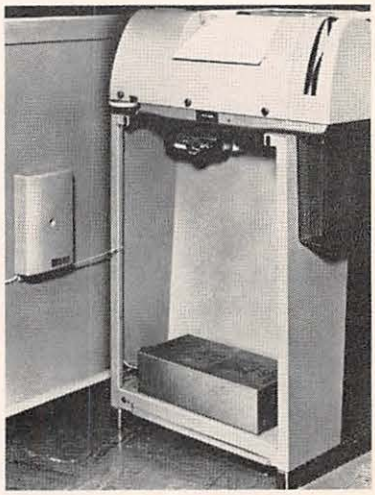
The all-solid state MS-218—a third generation 2-GHz microwave radio relay system features: MTBF of 9100 hours per Tx/Rx combination, five watts transmitter power, 124 db system gain, crystal controlled oscillators, basic 2-GHz oscillator (no multipliers are needed), 55 db NPR with 300-channel loading, 8 db receiver noise figure, and built-in metering for simplified system checkout and maintenance.

The MS-218 meets industry objectives for 600-channel loading under short- and medium-haul requirements. It can serve either as a voice and data system or as a driver for scatter propagation systems. The MS-218 is available in non-standby, hot-standby, and diversity configurations. *Collins Radio Co.*

Acoustic modem is for portable devices (138)

The 703 acoustic coupled data modem provides a convenient, economical, and error-free method of data transmission when subscriber requirements include portable or frequently moved data terminals, teleprinters, or other digital devices. Capable of serial binary data speeds of up to 300 bits per second, the 703 data modem: is W.E. 103 compatible; features acoustic-acoustic or optional acoustic magnetic coupling; complies with Bell manual data access arrangement F57951 should direct line access be a system requirement; and offers both EIA-RS 232B and 20ma loop interface capability.

Available in an attractive desk-top cabinet, the unit's front-panel controls allow selection of originate or answer mode, half- or full-duplex operation, monitor speaker on/off, and power on/off. Front-panel lamps indicate modem ready, carrier received, and receive data-signal state. *Data Products Stelma Telecommunications.*



Data set designed for teletypewriters (139)

The T113ATS data set is designed for originate only teletypewriter applications up to 300 bits/second, full duplex on the DDD network via the Bell data coupler F57951 or 1000A. The T113ATS can replace the Bell or Sangamo 103A2 or 101C. The features of the 103A2 data set, not required in originate only applications, have been omitted from the T113ATS. *Sangamo Electric Co.*

Microwave antenna has elliptical waveguide (140)

A single polarized microwave antenna operating in the 6.575 to 7.125 GHz band features an EW59 elliptical waveguide. Attenuation for EW59 is 1.5 dB/100 ft at 6.7 GHz compared to 1.9 dB/100 ft for WR137, the corresponding rectangular waveguide. The elliptical waveguide usually can be connected directly to the antenna,

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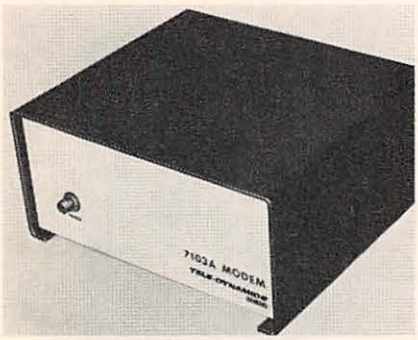
eliminating the need for an elbow or flex section.

Radomes protect antennas from accumulation of ice and snow, and can be heated where severe icing conditions exist. The antenna and radome combination produces only half the maximum wind thrust on supporting structures compared with an antenna alone. *Andrew Corp.*



Data set gives full-duplex digital sending (141)

A data set provides full-duplex asynchronous digital transmission at rates to 300 baud on standard voice-grade telephone lines. Designated type 7103, the compact unit is available in three different modes: originate-only, answer-only, and automatic selection for originate or answer operation.

The solid-state, frequency shift keyed modems, which have less than 1% distortion, connect to standard teletype, computer processing, and other equipment compatible with EIA standard RS-232-B. The units require an input signal level of −40 to +3 dbm. The output signal is −20 to +3 dbm, continuously adjustable. Mark frequencies are 1270 and 2225 Hz; space frequencies are 1070 and 2025 Hz.

The 7103 data sets come in a portable desk top case or can be supplied on a printed circuit card for use as an integral part of a system. Both the desk top and PC versions come with or without an internal power supply. External power requirements are ±15 volts DC at 4 watts. *Tele-Dynamics, Division of AMBAC Industries Inc.*

Encoder designed for dial access paging (142)

Model 2DME encoder was designed for use in dial access paging.

Two tone models have a code capacity of 100, 200, 600, or 1000 two-tone sequential codes. Single tone models (1DME) are available with capacities from 10 to 40 codes. Larger

(Please turn to page 60)

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insulated rail joints

more than 90 railroads know of its performance reliability

Now used by more than ninety railroads, VulcaBond insulated rail joints are rated "ideal" in these vital track applications: retarder yards . . . transit systems . . . automated and electric railroads . . . grade crossings . . . signal locations.

VulcaBond is a proven success in railroad installations coast-to-coast because it delivers *lower* maintenance costs and *higher* operating efficiency.

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And it resists grease and oil while maintaining 10,000 megohms resistance or more.

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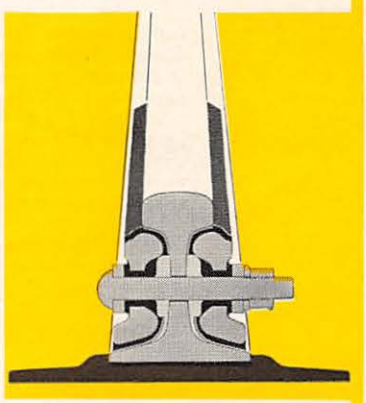
No wonder the VulcaBond insulated rail joint is a success. It does the job. Write for VulcaBond literature V-969R.



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Circle 26 on reader service card

PRODUCT NEWS

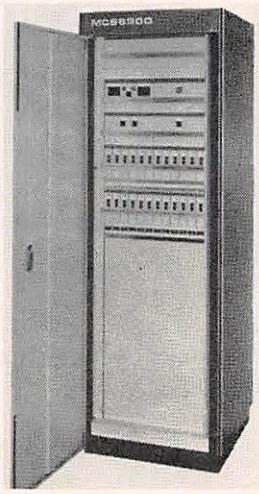
(Continued from page 59)

code capacities are available. The code capacity of any encoder in the series can be simply and economically expanded by plugging in additional circuit cards. Group call can be added in the same way. The equipment as expanded can thus be easily checked, by either dialing a number or selecting a number on a 12K3 selector and visually checking to see if correct digits are displayed on read-out.

To operate "locally" a 12K3 selector is installed for each operator. In this way several operators can use one encoder. Installed as a dial access, the encoder requires an interface circuit between the encoder and the telephone system. Any telephone in the system then becomes a dispatch point. The encoder (3½" x 19") allows it to be conveniently mounted in standard 19" racks. *Reach Electronics Inc.*

Multiplex gets 88 lines on voice channel (143)

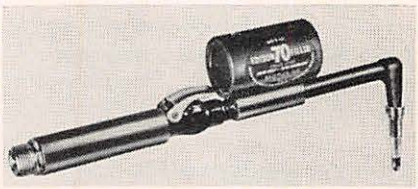
The TDX-2 (time division multiplexing system) is specifically designed to handle a large number of data channels without sacrificing data transparency. This multiplexer employs a character interleave technique to multiplex as many as 88 channels over one voice grade telephone line. Among the UBC TDX-2 features are unlimited speed intermix of 110, 134.49, and 150 bps; synchronous high speed channel intermix capability; and a variety of status monitoring devices and diagnostic capabilities. *United Business Communications, Inc.*



Microwave has pulse code modulation (144)

The MCS 6900 is a new 100% solid-state microwave multiplex system using pulse code modulation (PCM). The MCS 6900 has a capacity of 120 voice channels expandable channel-by-channel.

A feature of the MCS 6900 is that unrestricted baseband access up to the full capacity of the system is available at all repeaters. Each voice channel can accommodate as many as 56 teletypewriter channels—or a combination of teletypewriter, data transmission or supervisory channels. Direct digital interface is provided for up to eight 2,400 bits-per-second data channels per voice channel. *Canadian Marconi Co.*



Battery filler is signal device (145)

A new semi-automatic storage battery filler for nickel-cadmium or nickel-iron batteries known as the Edison 70, features the combination of a filler and signal device in a single, self-contained unit that is compact and

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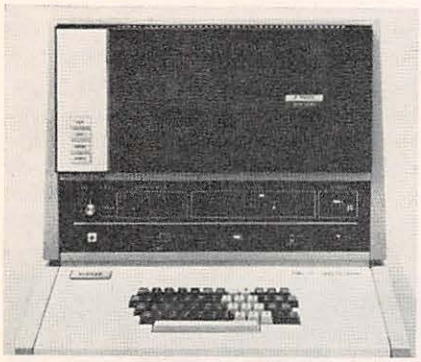
light in weight. It completely eliminates the need for a separate signaling device and connecting cables.

The signaling device is of solid state design and includes a visual as well as the usual audible signal. Both signals are actuated when proper battery electrolyte level is reached. The light signal permits the filler to be used even in exceptionally noisy surroundings. The entire signal unit operates on two, radio-type, 9-volt dry cells.

Three standard models are available: Model SS, which has a 7½" nozzle and is designed for batteries used in railway signaling and communications services. Its overall length is 16½" and it weighs only 2 lb 6 oz. Model SL has a 30" nozzle and Model SXL has a 42" nozzle. Both of these models are designed for watering car and other rolling stock batteries. *Primary Battery Div., Thomas A. Edison Industries.*



Keyboard inputs for magnetic recording (146)

A unique data origination system for keyboarding data for direct input to third-generation data processors is the 4300. With the new system, any user of conventional magnetic tape drives can produce input at speeds substantially faster than the keypunch /verifier operation. The system's keyboard is easily mastered, as it is similar to that of a conventional keypunch, and all data is displayed in English language.

The 4300 system consists of four units: 4301 magnetic data recorder, 4302 magnetic data keyboard, 4303 magnetic data central pooler and the larger-capacity 4304 magnetic data central pooler. The 4301 magnetic data recorder—the system's basic unit —is a self-contained, free-standing operator work station consisting of a keyboard, a display console and a magnetic tape deck which produces and also verifies high-density, computer-compatible magnetic tape for immediate computer entry.

(Please turn to page 62)

Communications problems?

RFL solves them.

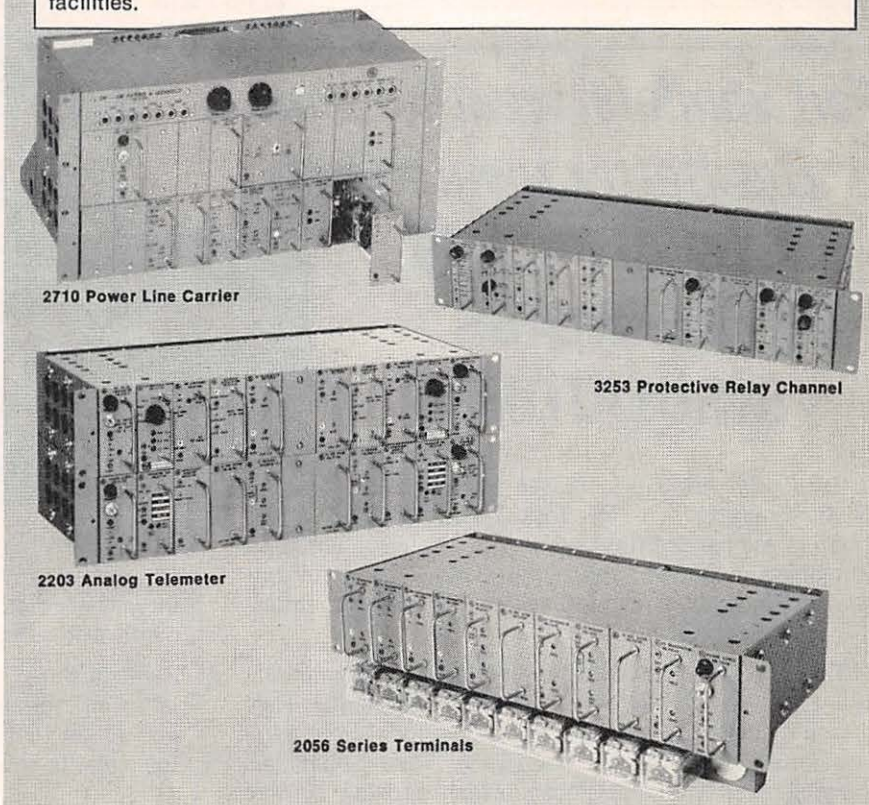
2056 Series Terminals
These AM and FS audio terminals maximize the concept of tone channel design. They accommodate *all* tone channel requirements in a single package. AM can be intermixed with FS channels, receivers with transmitters, in any combination. Basic modules are common to all applications, and accessory modules on plug-in cards adapt to special systems.

3253 Protective Relay Channel
For maximum false trip security. Designed specifically for power utilities, it will discriminate between a fault condition and noise; interference; communications opens or shorts; power supply failures; or a combination of these . . . trip in as little as 8 milliseconds when the fault is legitimate. Fully compatible with all VF facilities.

2710 Power Line Carrier
Solid state, single sideband voice terminal for power or static line applications. Five duplex channels for 3.2 to 62.5 kHz, or 60 to 108 kHz. Plug-in modules and accessories such as compandors and regulators provide for wide variety of special applications.

2203 Analog Telemeter
Highly accurate variable frequency type telemeter for transmission of analog signals via telephone line or radio circuits, over any desired distance. Any input above a 20 mv span can produce outputs up to 50 ma for direct drive of indicating instruments and recorders.

RFL also manufactures a full line of Bell compatible data sets.



WRITE FOR COMPLETE INFORMATION TODAY!

RFL Industries, Inc.
Communications Division • Boonton, New Jersey
TEL. 201-334-3100 / TWX: 710-987-8352 / CABLE RADAIRCO, N.J.

Circle 32 on reader service card

PRODUCT NEWS

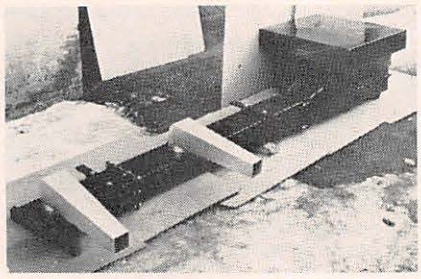
(Continued from page 61)

If an even larger configuration is needed, the 4304 magnetic data central pooler can accommodate up to 64 remote terminals. *Friden Div. Singer Co.*

Video terminal has 2-page capacity (147)

A new video data terminal that offers a two-page, 2,592 character capacity, called the VST 2000, gives data transmission rates as high as 1200 baud (2400 baud optional) for computer communications. The terminal is interchangeable with any teletypewriter and requires no software or hardware modifications for interactive data communications.

It utilizes a standard typewriter keyboard plus a ten key adding machine keyboard for numerical entry. The terminal is self-contained, with keyboard, CRT, electronics, power supply and optional built-in hard wired coupler. When hard copy is desired, virtually any standard printer can be simply attached. *Video Systems Corp.*



Snow melter uses oil-fired heater (148)

The type HAB-HP switch heater is a complete oil-fired heating unit distributing the hot air through appropriate ducting. Operation may be manual or automatic. When fired automatically a Rails snow detector is required.

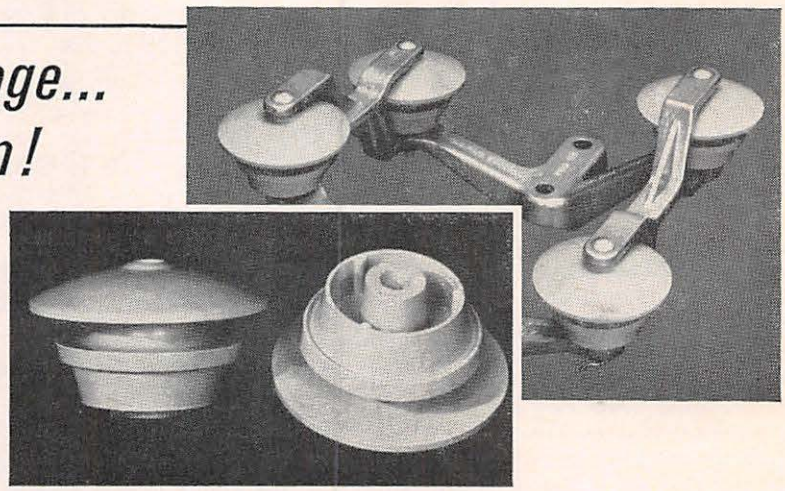
The combustion chamber incorporates proven burner principles and is constructed using stainless steels in combination with castings which incorporate an air adjustment for varying the BTU inputs. Design allows for a range of 1.5 to 2.25 gallons/hour input, but 2 GPH is furnished unless specified otherwise.

The main duct is insulated to safeguard against possible track circuit interference and is adequately dimensioned to prevent back pressure and provide maximum air flow. Shields are supplied for the outside of the stock rail to use as a secondary hot air duct when required. *Rails Company.*

Wire cutter can crimp terminals (149)

All functions necessary for applying crimp terminals or splices to wire are included on the Super Champ II hand tool. The pre-loaded wire cutter maintains its sharpness and provides positive cutting of even small size standard wire. The wire stripping section is complete with a gage indicating proper strip length, and the crimping

Foil vandals, weather, age...
Get Better Insulation!
NEW TOPO T-15 FIBERGLASS INSULATORS



Good news for users of Case Transposition Brackets . . . New Topo T-15 Insulators are molded fiberglass — far stronger than glass against impact and tension stresses — far more durable than rubber against ageing, cracking, compression cutting by line wire.

T-15 Insulators will withstand rocks thrown by vandals —even light calibre bullets—without shattering. They won't shatter, explode, peel, or corrode from temperature extremes or weathering. Their volumetric resistance, double-petticoat design, and low surface conductivity make them more efficient electrical insulators than rubber in dry weather, than rubber or glass in wet weather. Tests by an independent laboratory confirm it — results available upon request.

Replace those vandal-broken and age-impaired insulators as they show up on inspection with Topo T-15's, and forget 'em. On new installations, specify T-15's for long-life savings and more effective insulation.

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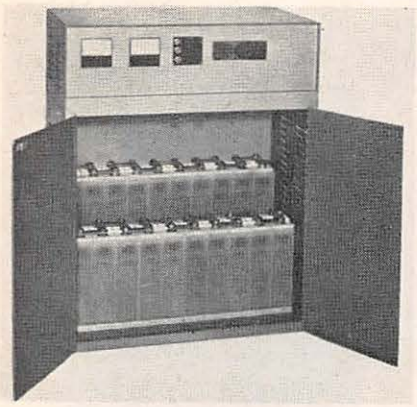
Circle 29 on reader service card

jaws are designed for use with wire ranging from AWG #10 to #22. Additional features include a bolt cutter and a stud size gage. *American Pamcor Inc.*



Battery/converter gives AC power (150)

An automatic battery/converter system for applications requiring reliable standby AC power is available in 500 and 750 watt capacities, with batteries sized to furnish up to 6 hours' continuous performance. Sine-wave output distortion is held to 5%. All components are housed in a floor console, including 24-volt nickel cadmium storage battery, rotary converter, battery charger, and load-transfer circuits for fully automatic operation.

In the event of failure of the normal AC power, the converter is instantly energized, producing up to rated AC output within ½ second. When normal AC power is again available, the automatic transfer switches reconnect the load to the incoming AC—and deenergize the converter. Simultaneously, the battery charger is switched to its "high-rate" charging mode; when the battery is fully recharged, the charger is automatically switched to its "float" charging mode to maintain the battery in a fully charged condition. *Nife Inc.*

Frequency measured by dialing digits (151)

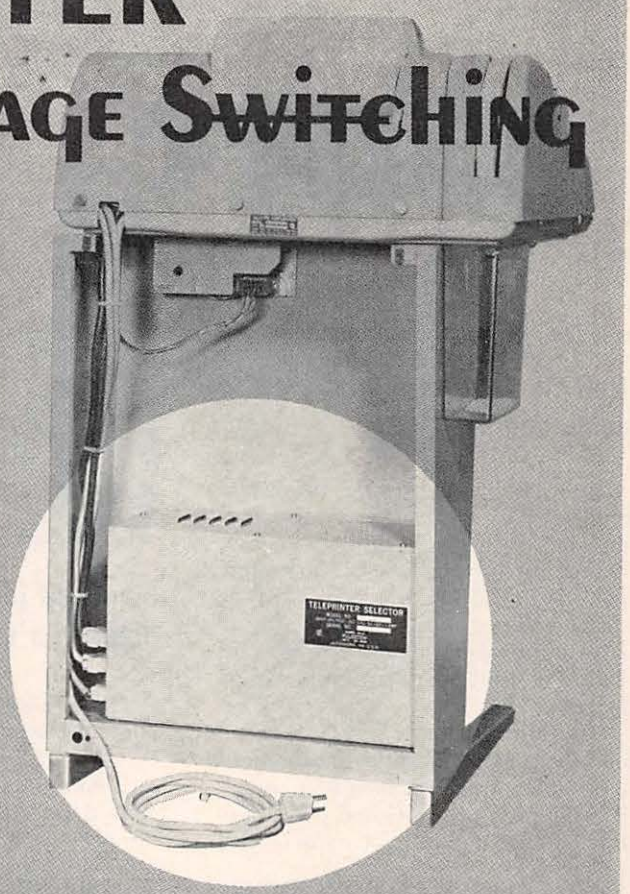
A synthesizer-type combined frequency meter/signal generator with broad frequency coverage is model FM-10. This portable device has instant-on operation and operates off a 12-volt battery or AC line voltage.

The frequency spectrum is 50kHz to 1000MHz and any frequency in this range can be measured or generated by dialing in the digits with decade switches. The decade switches act as a digital readout display when

(Please turn to page 64)

BETTER
MESSAGE SWITCHING
FOR

81D1
83B
8A1
8B1
85
86
115
135



AND MANY OTHER SYSTEMS

Private line, multi-station teletype systems with automatic message switching have become a basic tool of business communications . . . and contribute significantly to corporate operating expense.

Pulse Communications has developed a line of equipment which increases the efficiency of these systems and, at the same time, dramatically reduces their operating costs.

Foremost among this equipment is a series of Teleprinter Selectors: solid-state stunt boxes which implement the selective calling feature and additionally provide numerous control functions that enhance the flexibility of the terminal. These terminals are direct replacements for equipment typically leased from Bell System and Western Union. The Pulsecom equivalents reduce initial system cost, reduce operating costs, and increase system efficiency.

Interested? Call us.

PULSECOM

5714 COLUMBIA PIKE, FALLS CHURCH, VIRGINIA 22041
TELEPHONE 703/820-0652 TELEX 89-9423

Circle 30 on reader service card

PRODUCT NEWS

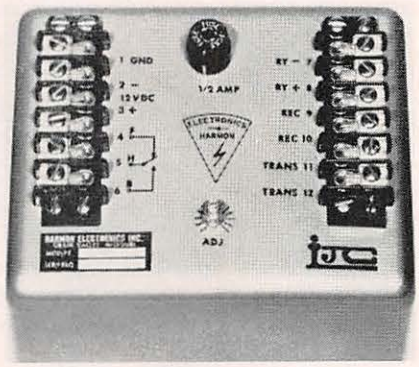
(Continued from page 63)

the FM-10 is used to measure frequency. A choice of plug-in modules is available in addition to the mainframe which equip it to measure and generate AM and FM modulation. The frequency setting of the FM-10 can be varied continuously over search bands of 1MHz, 100kHz, 10kHz and 1kHz to find "lost" transmitters. *Singer Co., Electronic Products Div., Gertsch Operation.*

New tie holds wire and cable bundles (152)

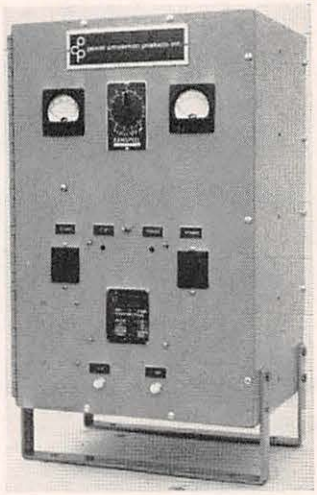
A new cable tie provides a fast and economical method for securing a harness and then mounting it to another harness or any convenient mounting point. The SSB2S Bow-Ty cable tie accommodates any two bundles up to an approximate total diameter of 1¼". The tie is standard cross-section and 6¾" long.

The initial harness can be secured and then mounted to another harness, a cabinet, or other mounting point. The Ties are prepositioned on the initial harness and can be color coded for positive identification. They are all-nylon with no metal barbs, no twisting needed to secure on the bundle. Standard color is natural nylon with 10 other colors available. The SSB2S ties are immediately available in standard packages of 100 and bulk packages of 1000. *Panduit Corp.*



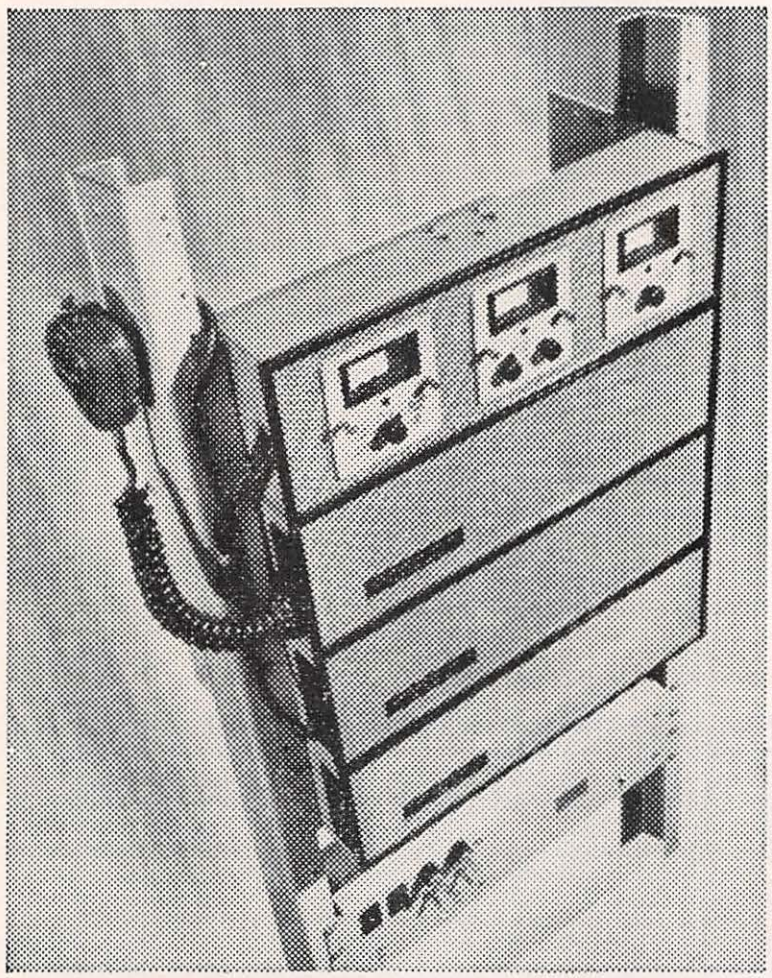
Insulated joint checker housed in cabinet (153)

Model 1500A permanent insulated joint checker is housed in a cabinet 6" x 5" x 5" and requires an external 10.5 to 14.0 volts DC power source. It is designed either to drive an external 500 ohm relay, or provide dry relay contact output. The 1500A is adjusted on installation for relay dropout at any selected minimum DC resistance between .5-100 ohms across a single joint. *Harmon Electronics, Inc.*



Constant voltage charger is current limited (154)

The TC charger is a transistor regulated, constant voltage, filtered, and current limited battery charger,



The new FCC rules drastically limit the areas where the 450-470 MHz band can be used for point-to-point communications — and give you a couple of years to make the changeover if you come under the new rules. But doesn't it make sense to change to 960 MHz now, before the rush is on? Particularly when you have available to you, from Cardion, the first solid-state, FCC type-accepted 952-960 MHz radio relay equipment in the industry.

Cardion's new equipment extends the state-of-the-art. You can get up to 5 separate voice channels, each with its own control circuit uplink and carrier-operated relay circuit downlink. You can get duplex operation over a single pair of radio frequencies with just one antenna and one transmission line. And you do get a built-in service channel, independent from multiplex equipment.

So why not go Cardion 960 *now?* That way you make sure you're not held up by any last minute delay in equipment . . . and you make sure you stay on the air.

Cardion ELECTRONICS

A UNIT OF GENERAL SIGNAL CORPORATION

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■ TWX 510-221-2179 ■ 516-921-7300

Circle 31 on reader service card

using silicon diodes for rectification and power silicon transistors for control. A current limiting circuit allows a completely discharged battery to be charged at a constant current, while limiting the current to a safe value in case of a severe overload or short circuit.

AC input is 120/240 volts, 1 phase, 60 Hz. DC output is 6 volts, 12 volts, 24 volts, or 48 volts; various currents up to 12 amp. Output voltage regulation is ±1% from no load to full and with ±10% AC input change. Ambient temperature is 45°C (113°F) max. Protection includes AC fuses and transient surge protection. AC "off-on" switch. DC fuses not required. Meters are 2% DC ammeter and 2% DC voltmeter. *Power Conversion Products Inc.*

Pushbutton phones give remote controls (155)

Single-digit, Touch-Tone receiver modules permit users to build a remote control network with standard Touch-Tone telephones. Designated as the MD42 series, there are 12 models, one to match each of the 12 standard sets of simultaneous Touch-Tone frequencies in use. LC filters first decode the tone, then energize a transistorized logic circuit to trigger a DPDT form C output relay. The relay remains energized as long as the buttons are depressed.

The modules can be connected directly to telephone lines through data couplers supplied by telephone companies or indirectly through acoustic couplers. A major advantage to the decoder design is that users already have easy and economical access to Touch-Tone telephones. A single telephone constitutes the entire encoding portion of the 12-digit control system. Available with both DC and relay outputs, standard MD42 modules have power inputs of 12, 24, and 48 volts DC or 120 volts AC. *Bramco Controls Div., Ledex Inc.*

New test set finds faults in wire and cable (156)

A new test set provides an economical method for locating faults in all types of power and communication cable. By generating a pulse down a cable, this new set allows an operator to observe the reflection pulse caused by a discontinuity in the cable. Short circuits yield a negative downward reflection pulse which indicates an impedance lower than the characteristic impedance; open conductors yield a positive upward reflection

(Please turn to page 66)

What makes The Simpson TS-111 The Super-Value Signal Tester?

Plenty!

Uppermost, it's the first "all-in-one" signal tester suited to railroad needs.

The Simpson TS-111 is particularly designed to give these indications: • Percent "on" time of coded track pulses — with readout directly in percentage • AC voltages — even when AC is superimposed on DC track signals • Resistance — without fear of meter burnout. Special circuit warns operator if power is present • Peak currents — with no pointer oscillation, no guesswork. Built-in pointer stop is adjustable from the front panel • AC-DC current, AC-DC voltage, and resistance

What do these facts mean for the signal and communications maintainer?

Indeed, they assure accurate tests of circuits used for train control, remote interlocking, grade crossing protection, auto-block signals, and centralized traffic control.

Specific quality and performance features that make signal testing all so simple and certain with a Simpson TS-111 are detailed in Bulletin MD8692. Write for a copy today.

Sales Agents to the Railroad Industry: 5536

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Circle 28 on reader service card

If you want a tube distributor who knows your business, give it to him.

He's your RCA Industrial Tube Distributor. No.1 in tubes for all communications applications.

What made him No. 1? Emergency service is one reason. It's like money in the bank.

For example:

A tube fails. You're out of replacements. Or maybe you have a few. Too few for comfort. So you call your RCA Industrial Tube Distributor.

He's set up to give you emergency service. Even after he closes his doors at night, chances are he'll be able to open his shop and find the tube you need to keep your line of communications open.

There are more reasons.

Experience. He talks your language, knows your needs. Some of our distributors have been in the communications business for as long as we have—40 years!

Quality. Your RCA Industrial Distributor stocks the finest line of tubes for aviation, rail, mobile and fixed station communications. In power tubes, for example, brand preference studies conducted by leading electronic publications have listed RCA as the first choice of professional designers year after year!

Inventory. The widest. Transmitting tubes, receiving tubes, rectifiers, cathode-ray tubes, light-sensitive tubes, vidicons. Think of his establishment as your tube warehouse. For all practical purposes, that's what it is!

Need more reasons? Call your local RCA Industrial Tube Distributor. For starters, ask him for the new 1970 Guide to RCA Industrial Tube Products, or write: RCA Electronic Components, Commercial Engineering, Dept. 135I, Harrison, N. J. 07029.

RCA

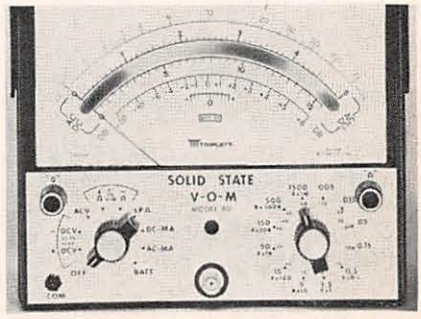
PRODUCT NEWS

(Continued from page 65)

indicating an impedance higher than characteristic. Fault resistance between a short and an open may also be observed, however, these in-between resistance values yield a reflection pulse amplitude in direct proportion to the magnitude of the discontinuity or fault.

Operable range extends from 2 yd to 10,000 yd with an accuracy of ± 5% reading the CRT face-plate deflection, and ± 2% using an X-shift vernier. Cables having impedances from 10 ohms to 1,000 ohms can be tested with this unusually versatile and effective test set.

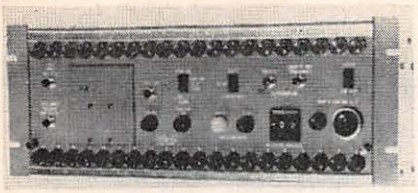
A sturdy, one-piece watertight case houses both cables and connectors. Total weight of rechargeable battery and instrument is only 17-½ lb. The set also operated from 115 or 230 volts AC (45-550 Hz) or from an external battery of between 11-15 volts. *James G. Biddle Co.*



V-O-M is battery-run device (157)

A new solid-state portable, battery-operated, volt-ohm-milliammeter, model 801, measures DC voltages, resistance, AC-DC current and AC RMS values. Model 801 V-O-M has such exclusive features as: low power ohms circuit for IC, transistor and other solid state components measurements; conventional ohms circuit with 1.5-volt battery power source useful for checking forward and reverse resistance of semiconductors plus offering polarity reversing function; 1 ohm center scale; high sensitivity starting at 5 mv AC full scale and a high 10 megohm input resistance; All measurements are made on a large 8" meter with simplified scale having only 2 arcs for AC-DC volts; only one small compact test probe with built-in sliding switch is used for all DC, AC, ma and ohms functions.

The Model 801 provides AC-DC current measurements 5 ua to 1.5 amp and permits DB measurements of −70 to 66dB. *Triplett Corp.*



Monitor device handles 60 locations (158)

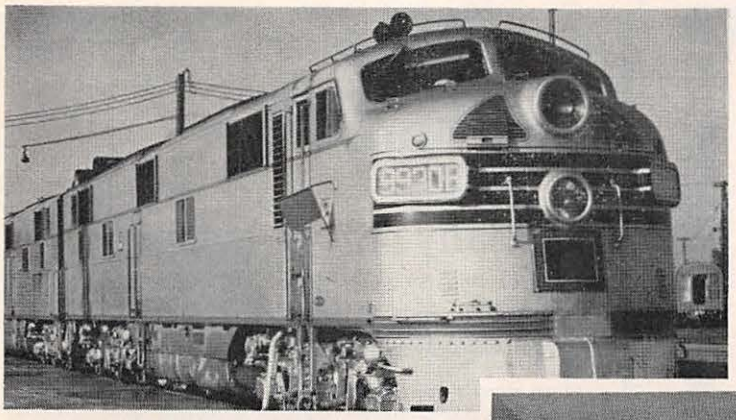
A command and monitoring device is able to control up to 60 remote locations. The monitored stations can be at any location served by full duplex common-carrier or private wire telegraph circuits, including telephone tone signaling equipment. Each of the remote locations will monitor 20 yes-no functions represented by either contact closures or voltage levels. Control at each location is maintained over 15 discrete functions.

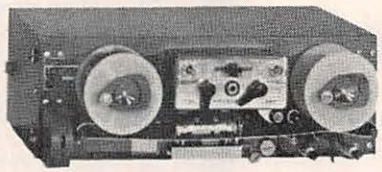
A permanent record of each command, and alarm or response can be made on the optional printout unit. To simplify operation at the master station, ASCII type coding is used throughout the polling, command, and response operations. This type of coding allows straight forward interfacing between the Datalok 7 system and the optional monitoring printout device. *Pulse Communication, Inc.*

Voltage transient device has tape recorder (159)

Model 802 voltage transient monitor is a complete transient detection system which includes a paper tape recorder, digital time display and duration and amplitude analysis electronics. The complete system is housed in a case 6.7″ high by 8.3″ wide by 12.0″ long.

By simply plugging the model 802 voltage transient monitor into any convenient power outlet the device automatically monitors the power line for voltage fluctuations. It alerts the user immediately, both visually and audibly, to the slightest power variation. The voltage transient monitor digitally displays the precise moment of the power variation and permanently records on a self-contained paper tape chart the transient duration and amplitude. *Data Research Corp.*





when verbal communications become critical

Railroads are becoming increasingly aware of the importance of maintaining accurate, permanent records of all verbal communications issued by railway dispatchers and other operating personnel. The availability of such records becomes of critical importance, particularly in cases of accident or freight loss.

The SoundScriber Communications Recording System provides a *proven* method of word-for-word recording which provides permanent, unalterable records which can be invaluable for verification of facts and for legal documentation. SoundScriber Recorders are used by these railroads: the Great Northern, the Northern Pacific and the Soo Line.

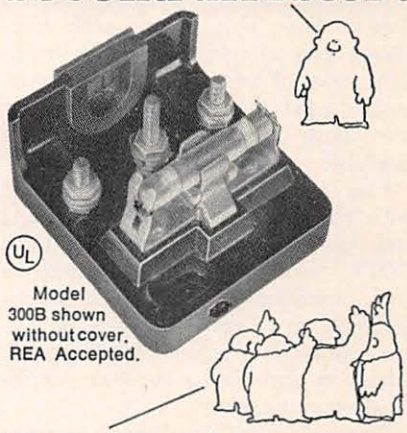
SoundScriber Recorders are economical, easy to install and operate — deliver years of reliable service. They provide 24 hours of continuous recording without changing tape reels. Write for complete details today. You may find that it makes good sense to fit SoundScriber Recorders into your communications system.

The SoundScriber Corporation

680 Third Ave., West Haven, Connecticut 06516

Circle 33 on reader service card

WHO Got rid of the second arrester?



Model 300B shown without cover. REA Accepted.

We did. With one 3-electrode gas tube. Why? Because UNLIKE double screw-in, 2 electrode arresters, our single gas tube stops offset metallic voltages which can appear across the lines and damage sensitive components of tone generating dials, key systems, PABX trunks and data terminals.

Series 400 shown with cover. Protector accommodates 2, 4 or 6 pairs.

U.S. Pat. No. 3,281,625 3,340,431

Use multiple protectors on business lines, mobile home parks, and apartment houses. Also as "buffer" protection between open wire and aerial or buried cable. Save carrier installations.

Many additional benefits:

- Tested for 72,000 surges without failure.
- Does *not* generate noise.
- Lowest replacement part cost.
- Exclusive, patented FAILSAFE feature.
- Permanent ground when crossed by power lines.
- Automatic C.O. signal if arrester is left out of protector.

Write for data sheets

TELECOMMUNICATIONS INDUSTRIES, INC.

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Circle 34 on reader service card

News Briefs

Surveillance by moonlight is here

U.S. forces in Viet Nam have often captured an enemy position because they've been able to see with television cameras operating in the moonlight. Special light amplification techniques used in military TV cameras have now been declassified and are available commercially.

Can security forces be provided with clear, sharp pictures of ramps and parking areas in a TOFC/COFC terminal without extensive and expensive floodlighting? Manufacturers say "yes"—this can be accomplished by using closed circuit television cameras having light amplification equipment.

These newly developed cameras and CCTV systems can provide clear pictures under normal night lighting, even as low as 0.05 foot candles (similar to moonlight). Six manufacturers now offer cameras or complete CCTV systems employing these new light amplification techniques: General Electric, Motorola, RCA, Sylvania, Texas Instruments and Westinghouse Electric.

For railroads, these new CCTV systems offer the advantages of remote viewing without adding extensive floodlighting. Most yards, station platforms, TOFC/COFC terminals, shop and service areas have adequate lighting now for these new CCTV systems.

A recent *Railway System Controls* survey reveals increased interest by railroads to provide TV surveillance in TOFC/COFC terminals, yards, and at commuter and transit stations where automatic fare collection is in service (turnstile viewing).

Although not requiring the new light amplification techniques, several roads use or plan to provide remote TV displays of train arrivals and departures, and train crew boards and registers. Video tape recorders coupled with portable TV cameras have been used by some railroads for education and training of personnel.

Four railroads share car-movement data

Illinois Central, Louisville & Nashville, Seaboard Coast Line and Southern can now inquire electronically of each other's computers to obtain car movement data. Established June 8, each road simply dials an inquiry into the computer center of any of the other three lines for data pertaining to location and status of their respective freight cars.

"This is the first step toward the day when railroads will be talking to each other via the computer on a routine basis pertaining to matters of car supply and service to shippers," said a joint statement by presidents Alan S. Boyd, IC, William H. Kendall, L&N, Prime F. Osborn, III, SCL, and W. Graham Claytor, Southern.

The combined computer operation will make available for the first time information on the movement of about 250,000 freight cars operating over 32,000 miles of mainlines.

SYSTEMS ANALYSIS AND RESEARCH CORPORATION
AND
XENEX CORPORATION
offer jointly computer systems consulting to the rail industry

- Information Retrieval Systems
- Car Control and Schedule Standards Systems
- Multiplexing Systems
- EDP Hardware Selection
- Financial and Economic Studies
- Operations Planning and Implementation

Call or write for our Railway Systems Brochure

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Circle 36 on reader service card

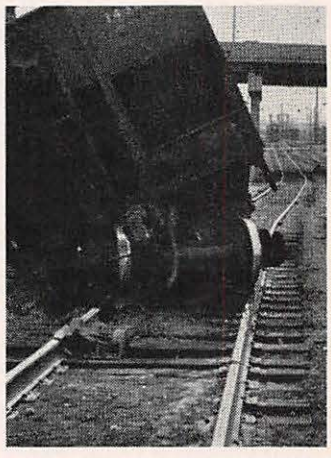
Hand-thrown or remote-controlled
Hayes **ALL-STEEL DERAILS**
physically protect the main line

Derails or signals? Each has its place: signals are obeyed by men; Hayes Derails are obeyed by equipment.

When signals are not involved, the Hayes Derail alone is competent to keep the main track clear.

In modern signal systems, the Hayes Sliding Derail with DeLectric® Operator under remote control provides complete protection.

The "calculated risk" of omitting derails may be costly. Hayes Derail protection is inexpensive.



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Editor's Corner

Communicate to serve

A railroad communications officer recently told me about a two-day visit of operating department management trainees to the communications department. These men were young college graduates. As part of their training, before being assigned positions in operations, they were spending time in each major department of the railroad to learn about its functions and role in the company organization.

"It was an exhilarating experience for us. The trainees were very sharp, knowledgeable and asked penetrating questions. It was an opportunity for us in communications to work toward a better understanding with these young men. Also, because some of these trainees may rise to top management positions, their understanding of the part communications plays in railroad operations will be invaluable," he said.

This cross-pollination of ideas between departments is a very useful thing, particularly when one of the parties involved is a service organization, such as communications. Service organizations in most firms are taken for granted. They do their work quietly, unobtrusively and usually do not grab the headlines for credit and glory. Along with communications, other railroad departments that are service organizations include accounting, data processing, industrial engineering, management systems or management services, and signaling.

DON'T CALL US, WE'LL CALL YOU

Indoctrinating management trainees about service organizations is just one of many aspects of this important area of communicating. Too often managers in line departments have the attitude "don't call us, we'll call you" about the service departments. Wanting to be independent, the line manager waits until the last minute or until it is too late to seek help from service groups. Planning with service groups can reduce or eliminate emergencies or limit them to manageable proportions.

Of course, one must realize that railroads are organized along military lines, which means that service organizations usually are staff groups, not line, hence they usually do not have the authority or rank to force their wishes on the line departments.

But giving the service organizations the authority or rank of line groups will not solve the communications problem. The best solution is cooperation. Working together on an informal basis can accomplish much. Service groups can take the initiative in bridging this communications gap. Service personnel at all levels—local as well as at headquarters—can meet and get to know their counterparts in the line departments.

In this way, little problems can be solved at the local level before they become large problems or major policy confrontations at the top or headquarters level. Often, informal discussions at lower levels in the hierarchy can be useful in promoting better understanding.

Admittedly one of the problems of understanding the work and role of service organizations by the managers or "generalists" in the line departments is that by its very nature, the service organization is staffed with specialists or experts in a particular area of work. Hence, they have their own jargon or technical language, they are very intense people, may be "eccentric" (like creative editors) and may give the impression of being a little bit superior because of their skill, knowledge and experience in a specialized area of endeavor.

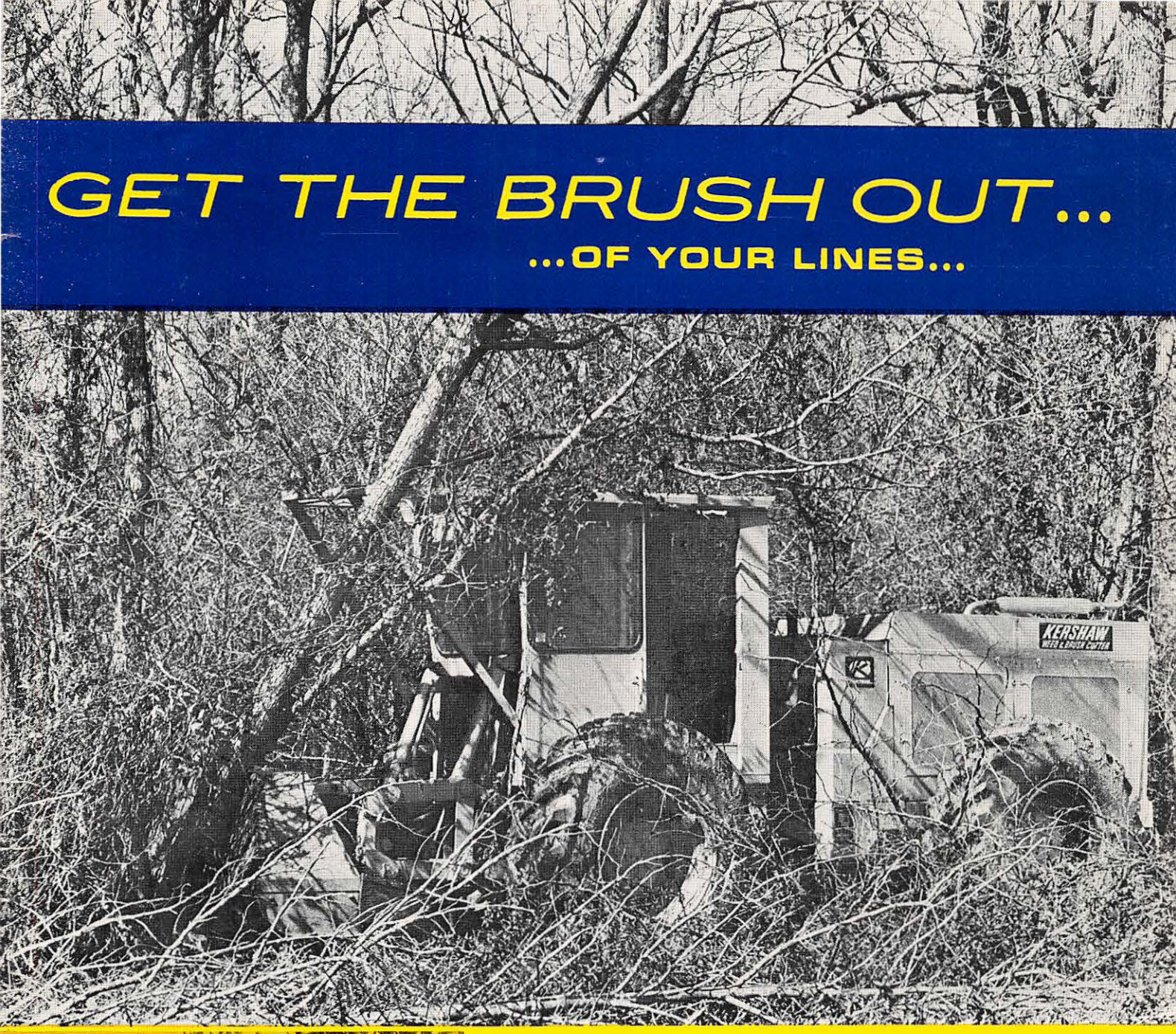
COME OUT OF YOUR SHELL

All this really shouldn't detract from their performance as service groups. But it does place a burden on the service man of requiring him to take the initiative in becoming better understood by the line organization man. The expert in service must come out of his shell and mingle with others.

"You have the capacity to understand the technical benefits and to interpret them into terms of practical and economic benefits. You have a responsibility to carry out effectively your part of systems development and operation and to plan for the future," said R. R. Manion, AAR vice-president, in addressing signal and communications men at one of their annual meetings. This advice also applies to other service groups including accounting, data processing, industrial engineering and management service departments.

GET THE BRUSH OUT...

...OF YOUR LINES...



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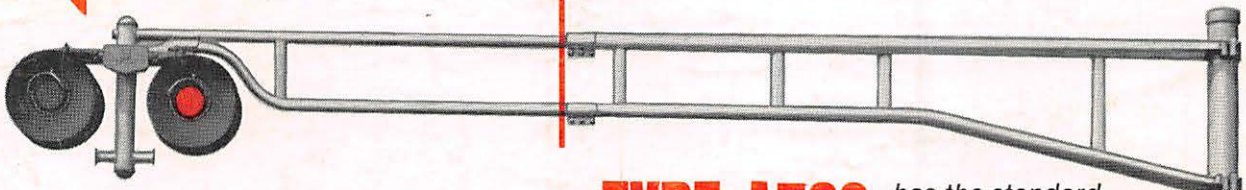
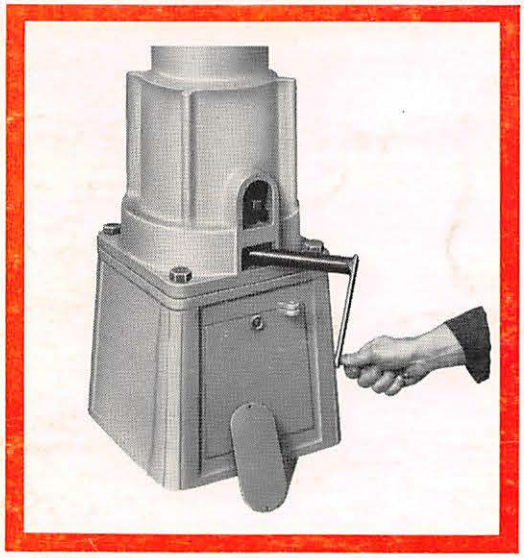


TYPE A760 *has the standard bracket arm in 12, 15 or 20 foot lengths.*



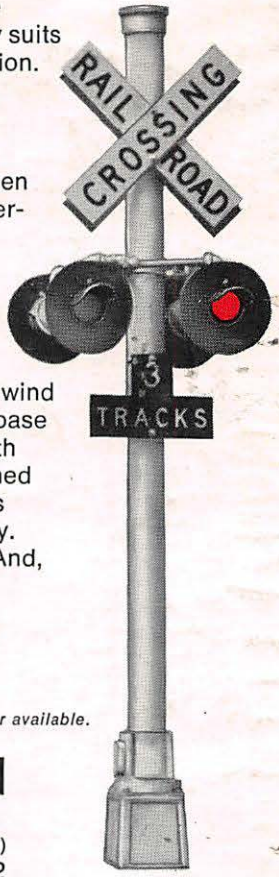
As you know, the standard bracket arm with the Western-Cullen Type A760 Cantilever generally suits most requirements precisely "to a T." No question.

The *telescopic* bracket arm with our Type A770 Cantilever, however, is specifically designed to provide adaptability for crossings that require intermediate lengths of arms—anywhere between 15 and 20 feet. Telescopic arms are ideal, furthermore, for use at crossings where there is likelihood of future widening of the highway.

Other than that, both types of Western-Cullen Cantilevers have the same basic features to assure overall enduring performance.

Examples: They are built to withstand 100 MPH wind pressure; with 17 foot road clearance. Safe, at-base releasing and revolving of the bracket arm—with automatic, positive locking when the arm is turned off-highway. Throughout servicing, indication is maintained, as the main mast remains stationary. You know, too, anodized aluminum is durable. And, to top it off, these units are easier to install and maintain.

In fact, Western-Cullen has a cantilever to meet your every need. The choice is yours!



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